# POPULAR MECHANICS

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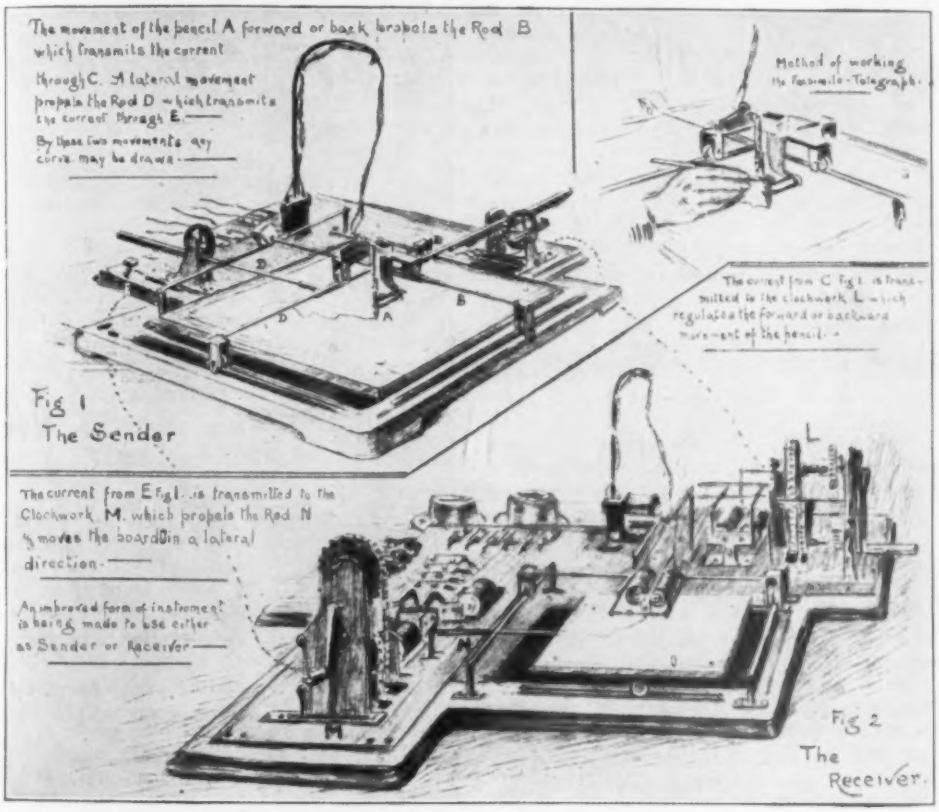
## Facsimile Writing at Long Distance

### New French Apparatus Which Makes It Possible to Sign a Check Thousands of Miles Distant


The movement of the pencil A forward or back, propels the Rod B which transmits the current
Through C. A lateral movement propels the Rod D which transmits the current through E.
By these two movements any curve may be drawn.
Fig 1
The Sender
Method of working the Facsimile-Telegraph.
The current from C Fig 1. is transmitted to the Clockwork L which regulates the forward or backward movement of the pencil.
The current from E Fig 1. is transmitted to the Clockwork M. which propels the Rod N & moves the board in a lateral direction.
An improved form of instrument is being made to use either as Sender or Receiver.
Fig 2
The Receiver.

**Long Distance Electric Writing Machine**

A man can sit in his room in a hotel in San Francisco and sign a check in New York, which the cashier of the bank there will honor, when the new device for long distance facsimile writing comes into general use. Not only can one send his own signature as rapidly as lightning flashes, but he can transmit an entire letter or legal document, all in his own unmistakable penmanship. All the eccentricities of his handwriting, the peculiar formation of certain letters, his special habit of dotting "i's" and crossing "t's" will appear with perfect accuracy at the further end of the line. Pictures also may be transmitted in the same way, and the escape of criminals will become more difficult than ever before. This remarkable instrument is the invention of a French

scientist, Professor Cerebotani. It will copy exactly the writing, drawing or marks made by a person holding the pencil of the transmitter. This wonderful instrument produces its complicated movements with only one wire.

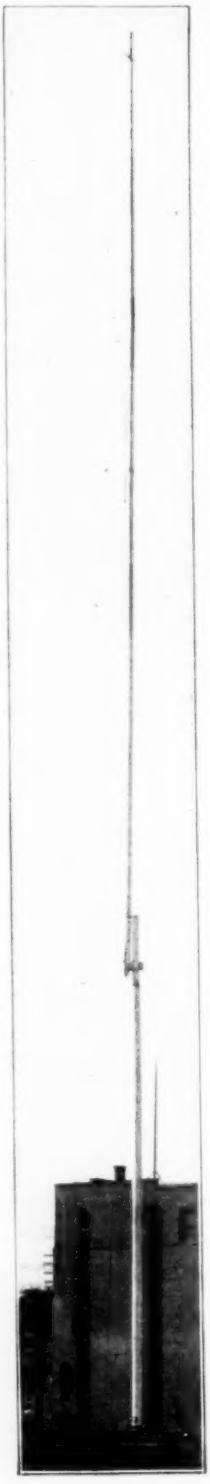
Any curve may be drawn by the two movements made by the sender shown in Fig. 1. If the pencil A is moved, either backward or forward, it propels the rod B, which transmits the current through C, this constitutes one movement. The other is the lateral movement which propels the rod D and sends the current through E. A hand operating the pencil is shown in Fig. 3. Fig. 2 shows the receiver and its connection with Fig. 1, the sender. The current from E, Fig. 1, produced by the lateral movement is transmitted to the clockwork, M, which propels the rod N and so moves the board, O, in a lateral position. In like manner the current, from C, Fig. 1, produced by a backward or forward movement is transmitted to the clockwork L, Fig. 2, and so produces the same movement there. The inventor is now working on an apparatus which can be used either as a sender or a receiver.

## HOW TO TELEPHONE FROM EVERY ROOM IN A RESIDENCE.

In a number of business places and some residences telephone connections making it possible to telephone from every room by the use of only two telephones have been established. In the walls of each room plugs connecting with the lead from the exchange to the residence are placed. A fixed telephone does the ringing for the whole house and another 'phone is carried by the occupants of the building to whatever part of the house they are engaged in. When the bell rings, the plug of the movable 'phone is placed in the one in the wall and the person talks just as well as if he had run down a flight of stairs or two.

## IRON-BAND PAVEMENTS.

A new kind of pavement being tried in Germany is called "iron-band pavement," and consists of artificial stones of concrete held together by iron bands. Where there are street car lines, joining stones are laid along the rails, which insure less deterioration of the rails and easier motion of wheels of vehicles. The pavement is said to be very durable, cheap, easily made, free from dust and can be used again when torn up.



## WIRELESS TELEGRAPH POLE 212 FEET HIGH.

Los Angeles has a wireless telegraph pole which lifts its slender spire 212 ft. into the air, just 100 ft. higher than any other pole in the city. The tall pole has been a matter of popular interest and during its erection crowds gathered daily to watch the progress of the guying and the painting; the steeplejack who did the painting, appearing very small, like a crawling insect, to the people watching below.

This pole is a part of the first station of a wireless line to be established between Los Angeles and Puget Sound.

## PERILOUS PLACE TO SLEEP.

Tramps are not the only ones, it appears, who ride in dangerous places, out of sight under cars. Many theatrical companies traveling in their own cars, have been using the "tool boxes" suspended beneath the floor of the car as sleeping bunks for the stage hands and roustabouts. In these dangerous, cramped and coffin-like boxes, little more than a foot above the rails, the men spend a dusty, uncomfortable night. In case of a wreck their location means almost certain death. Some railroads are now refusing to haul cars used in this manner.

# Hoisting Heavy Loads With Magnets

## Mysterious Operation of An Invisible Power a Great Time Saver

A pile of pig iron lay rusting in the back yard of a great iron works. There were tons upon tons, each block of iron weighing several hundred pounds. Suddenly, and without any apparent reason, the arm of a crane swings over the mass, and a plain block of steel descends until it rests upon the top of the heap.

In an instant, like a sleeping army called to arms, the inert iron bars awake from their lethargy, and climbing over one another, each endeavoring to be first, cling to the steel block until there is no longer room for any more.

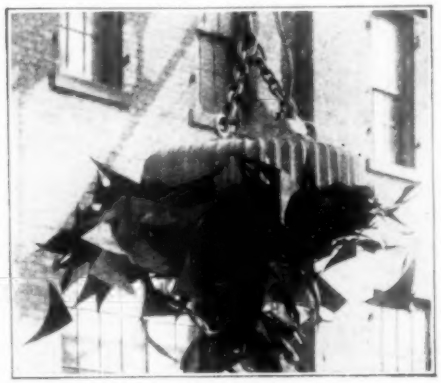
No human hand has touched the pile; no human form is visible; no explosion or earthquake has occurred to explain this strange behavior.

It is all simply the result of touching an electric button which set in operation the wierd, mysterious workings of a magnetic crane.

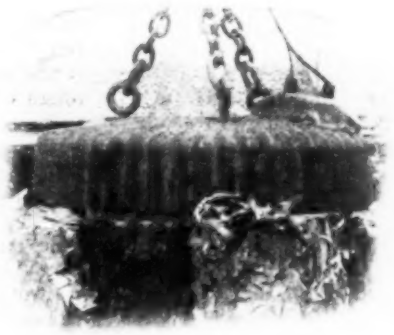
Could the intelligent workman of an hundred years ago have witnessed the scene, he would have had little choice between an exhibition of the supernatural and the belief that he had lost his mind.

And yet the scene described is rapidly becoming a familiar one in our large industrial iron works, in many of which not one, but a score of lifting magnets are in constant daily use. The operation, moreover, like many another wonder-producing effect, is extremely simple and easy to understand.

The block of steel which constitutes the magnet is suspended from the hook of the crane, and becomes magnetic or loses its power, when a direct current of electricity is allowed to energize the magnet, or is cut off.



**Sheet Iron Going Up**

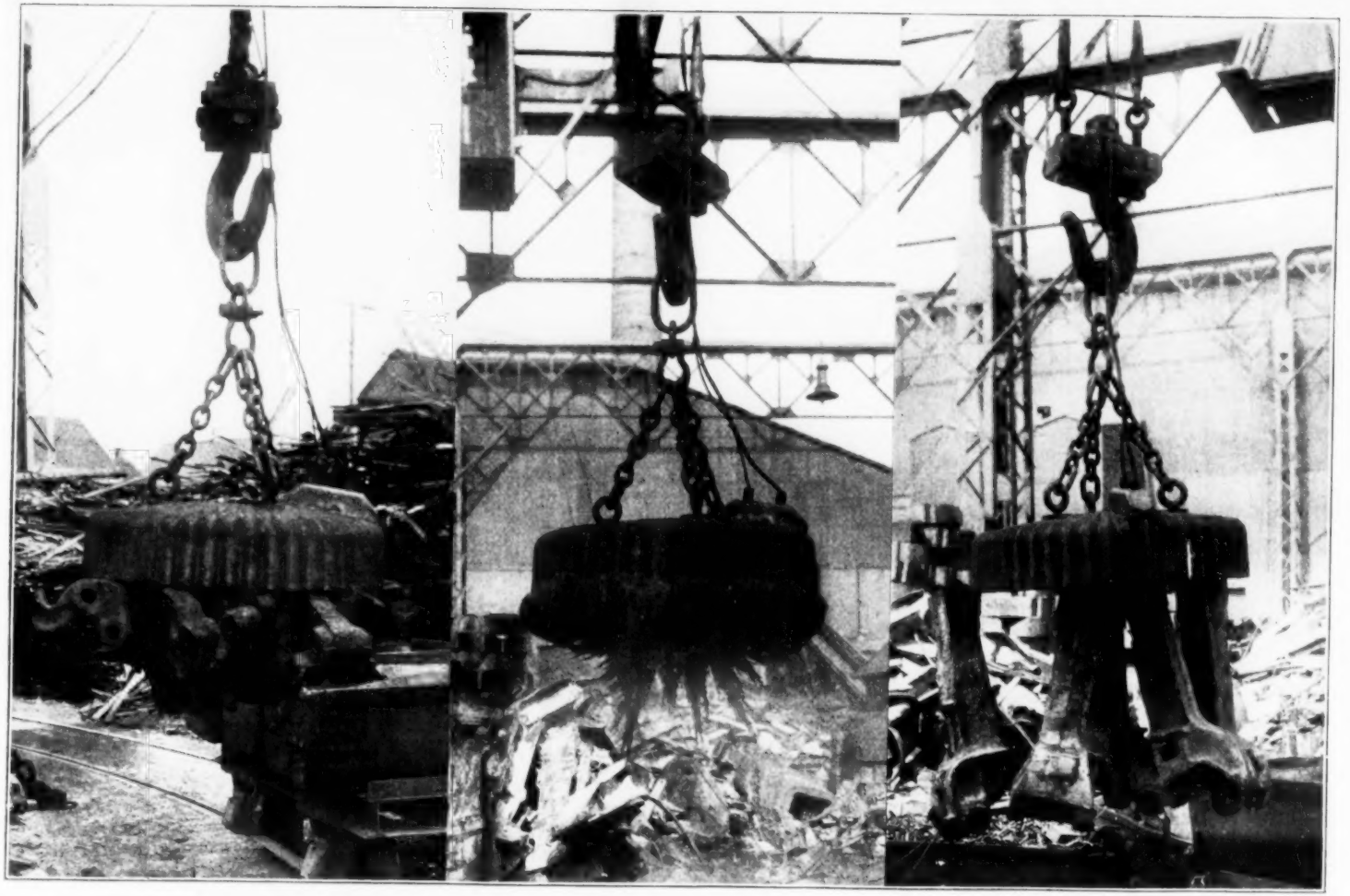


**Lifting Baled Tin**

A flexible twin conductor cable is used to convey the current to the magnet and a small switch operated by the crane man is usually the only additional apparatus necessary. The amount of current used is small, being from one to twelve amperes, according to the service for which the magnet is designed.

In operation, the magnet is lowered upon the material to be lifted, and the switch closed, thus causing the magnet to attract and hold the material, which may then be hoisted by the crane and transported to the desired point. By simply opening the switch the current is cut off, the lifting block loses its attracting power, and the material is instantly released, being deposited where the operator desires. The magnet will support its load in mid air for hours, and days and even endless years, if only the electric current continues to flow through the two small wires.

Comparing this method of operation with the common methods of connecting the load to the hook of the crane, with chains, hooks or clamps, the saving in both labor and time is apparent. The attachment of the magnet to the load, as well as the release of the load, may be accomplished by the crane operator without assistance, thus saving the labor of one or more men for prying up the material, attaching the hooks and chains



Car Coupler Knuckles

Machine Borings

By Courtesy of the Electric Controller & Supply Co., Cleveland, O.

Car Couplers

at the point of loading and additional men at the point of delivery for unhooking the load from the crane.

Magnets can be so quickly attached to and detached from a load that by their use the work which may be done by a given crane is greatly increased, in some cases more than doubled. It frequently occurs that the attachment of lifting magnets to existing cranes so increases their capacity for handling material that the purchase of additional cranes for handling an increased output is rendered unnecessary.

Again, lifting magnets require much less head-room than hooks or chains for lifting material of considerable width such as plates. Therefore, by the use of magnets materials can be conveniently piled to a greater height in the storage space under a given crane than is possible when chains are used, thus increasing the capacity of a given storage space without altering the crane runway or increasing the size of the building.

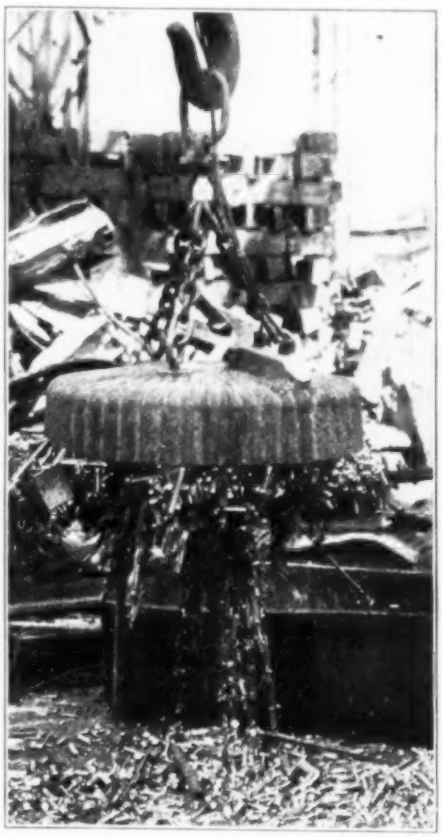
Lifting magnets may be used to great advantage in handling pig iron, scrap, rivets, bolts, great sheets of steel, and countless metal articles of similar character. In the illustrations are shown a few of the many operations of the lifting magnets. In one pig iron is being raised, in another scraps of tin, in others scrap iron and similar material.

A single design of magnet is not adapted to handling the full range of material above mentioned, on the contrary the magnet must in every case be designed to meet the form of material to be handled. For instance, there is a wide difference in the design of a magnet for lifting ingots or blooms and one adapted to the handling of thin plate. A magnet which would handle five tons in the form of an ingot might not handle five hundred pounds in the form of thin plates. It is therefore necessary to understand in each case the operating conditions with special reference to the form and range of material to be handled.

Magnets are always built and tested to from four to five times the specified load, special testing machines being employed by the makers for the purpose. There are some forty types of magnets built for as many different kinds of work. The rapidity of the operation may be understood from a few sample tests. A magnet built to lift 800 lbs. of pig iron at one time performed the operations of lowering the magnet, attaching the load, raising, transferring and depositing it at the rate of one ton in three minutes.

For "skull-cracker" work, which consists in raising a ball weighing from one to six tons and dropping it upon iron castings which are to be broken, the magnet system is a great saver of time, and the ball can be dropped with the same accuracy as an expert gunner on a battleship places his shot in a nearby target.

The evolution from the little red horse-shoe magnet of childhood to the great silently working hoisting magnets which deal in tons, forms another example of how modern industries have adapted and put to practical use principles which only a few years ago were confined to child's play or merely interesting experiments on a very small scale in the college lecture room.



**Lifting Small Scrap Iron**

Russia's sunken warships will be raised from the deep by three salvage steamers chartered at Antwerp by Japan. The steamers are equipped complete with modern wrecking machinery.

## HOW TELEPHONES HELPED THE JAPANESE.

During the present war the attention of the world has been called to the remarkable ingenuity of the Japanese in adapting modern devices to their own particular needs. Among others the introduction of the telephone on to the field of battle is most noteworthy, as it has enabled a ruling head to control the movements of each division of an army when scattered over

**Japanese Field Telephone at the Front on the Shaho**

many miles of territory. Hitherto in warfare the general plan of attack was prearranged at a conference of the commander and chief with his subordinates. This plan they endeavored to carry out to the best of their ability, but oftentimes unforeseen circumstances would arise which rendered an immediate change of tactics necessary, and aid de-camps and couriers were attached to the general's staff whose duty it was to convey his orders to one division or another whenever he deemed a change of plan advisable. In cases where the different commands were in close proximity this method was fairly satisfactory, but otherwise it was a slow and most dangerous practice, and is quite inadequate to the requirements of modern warfare.

The Japanese army in its operations around Mukden was often distributed over many miles, and in some of the recent engagements their fighting line has extended to the extraordinary length of an hundred miles. Regardless of this their unity of action and concentration of efforts have been most conspicuous and they were possible only through their ingenious use of portable telephone apparatus. Whenever a detachment of the army entrenched the engineers followed, and setting up an instrument soon had instantaneous communication with headquarters. By this means Field Marshal Oyama seated at the temporary "Central," was enabled to direct the movements of each division of his 450,000 men, distributed as they were, with quickness and precision. There could be no blundering on the part of incompetent subordinates acting on their own responsibilities through lack of definite orders. Oyama, so to speak, had them at his fingers' ends. Did a regiment need reinforcements to complete an operation; was it advisable to concentrate the strength of the army at a certain point in the enemy's line, the necessary commands were telephoned to the respective parties and the maneuvers quickly made. Contrast this with the want of unity among the Russian leaders and we need seek no further for an explanation of the present status of the war.

## ANCIENT ROMANS DETERMINED OUR STANDARD RAILWAY GAUGE

Many persons no doubt have stood and looked down a railroad track and wondered how such an out of the way measurement as 4 ft. $8\frac{1}{2}$ in. came to be adopted as our standard railway gauge. It would seem that the responsibility for the choice of this measurement rests with George Stephenson, of locomotive fame. While inspecting some portions of the Roman wall through which chariots used to be driven, he discovered that deep ruts had been worn in the stone. Upon measuring the distance between them he found it to be in the neighborhood of 4 ft. $8\frac{1}{2}$ in., and not doubting that the Romans had adopted this gauge only after much experience, he determined to use it as a standard in the construction of his railroads. From that time on this measurement has been the standard gauge in England and the United States.

# Mining Coal With Compressed Air

## New Radial Machine Which Will Cut a Channel in Any Direction

Courtesy Ingersoll-Sergeant Drill Co.

**The Radial Coal Cutter**

Seated comfortably on a low stool, and directing its operations very much as the sighter directs those of a Gattling gun, the operator of the latest type of pneumatic coal cutter accomplishes the work of many men, without any weariness whatever to himself. There is as much difference between the old, painful way of excavating with a pick a seam of coal until ready for a "fall," and the machine work with compressed air as power, as there is between the efforts of the ordinary citizen trying to set up a stove pipe or having it done by a furnace man.

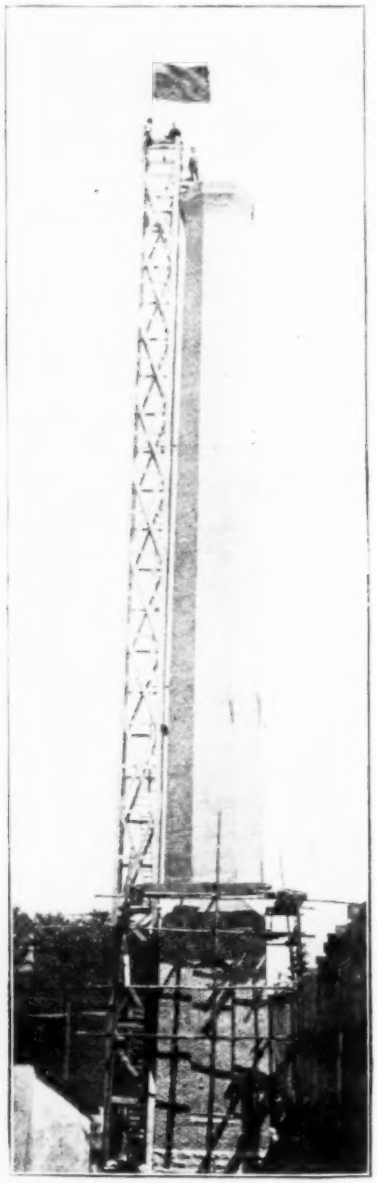
The machine coal cutter is a small engine which can be set in any position desired, using air instead of steam, and which drives a drill or chisel-shaped tool into the coal at the rate of several hundred blows per minute.

As an undercutting machine it is adapted for undercutting headings to any desired depth at a single setting. It will also shear either one or both of the sides of an entry, from the floor of the mine to the roof, to any desired depth at one setting. The cut made is 8 ft. in depth and diminishes from a width of 4½ in. at the face to about 2 in. at the bottom. In the illustration the machine is cutting a vertical shear, the point where the drill strikes being frequently changed by turning the small crank shown. The hose-pipe conveys the supply of compressed air which comes from a compressor. The workman at the right is cleaning out an undercut.

Thirty-one of England's old battleships, the original cost of which was $15,000,000, have been sold at auction for $680,000. The vessels cannot be sold to a foreign power, according to the terms of the sale.

## CHIMNEY BUILDING FROM A DERRICK IN CANADA

The accompanying engraving is from a photograph of a brick chimney erected by R. Corrick & Sons, for the new plant of the Sarnia Gas and Electric Light Co. The chimney is of red brick, built on a concrete foundation 9 ft. deep by 17 ft. square, and is 12 ft. 6 in. square at the base and continues the same form and dimension to a height of 28 ft. Above that it is of octagonal form 97 ft. high, with an outside diameter at the top of 11 ft. and finished with a cement cap, making the total height from foundation 125 ft. It is provided with a double wall to the height of 74 ft. 10 in.; 28 ft. of which is of fire brick, and the balance of ordinary brick, between which and the outside wall there is ample air space. The inside diameter is practically 6½ ft. throughout the entire height. The derrick, as seen in the photograph, was built its entire height before the chimney was commenced, and all material was hoisted up inside it. It is one of the largest chimneys of its kind in Western Ontario.—Contributed by A. E. Kaiser, Sarnia, Canada.



**Building a Chimney From a Derrick**

## WILL THE MISSISSIPPI BE HARNESSED?

A bill has been introduced into Congress granting a franchise by which a company will have the power to do with the Mississippi what has already been done at Niagara. Should this bill pass it is the intention of the men interested to build a large dam across that river between Keokuk, Iowa and Hamilton, Ill., and construct an enormous power plant which will develop a much larger horsepower than that obtained from the present plant at Niagara Falls. This plant with the dam is expected to cost in the neighborhood of $6,000,000 and will provide power for all towns within a radius of sixty miles. The dam, when built, will be nearly 5,000 ft. long and 35 ft. high and will be in complete control of the United States government.

## JAPANESE JINRICKSHAS MADE IN AMERICA.

It is not generally known that the jinrickshaw, the national vehicle of Japan, is manufactured in the United States and shipped in large quantities to the East. But so it is, and by constant redesigning and the application of various modern improvements the jinricksha has become in detail at least more American than Japanese. The vehicles are very light, being made for the most part of wood with wheels of steel tubing, many of which are equipped with rubber tires. Jinrickshas, though generally considered peculiarly a Japanese carriage, are also used in somewhat modified forms in China, South Africa and the Philippine Islands.

## RAZORS MADE OF COPPER.

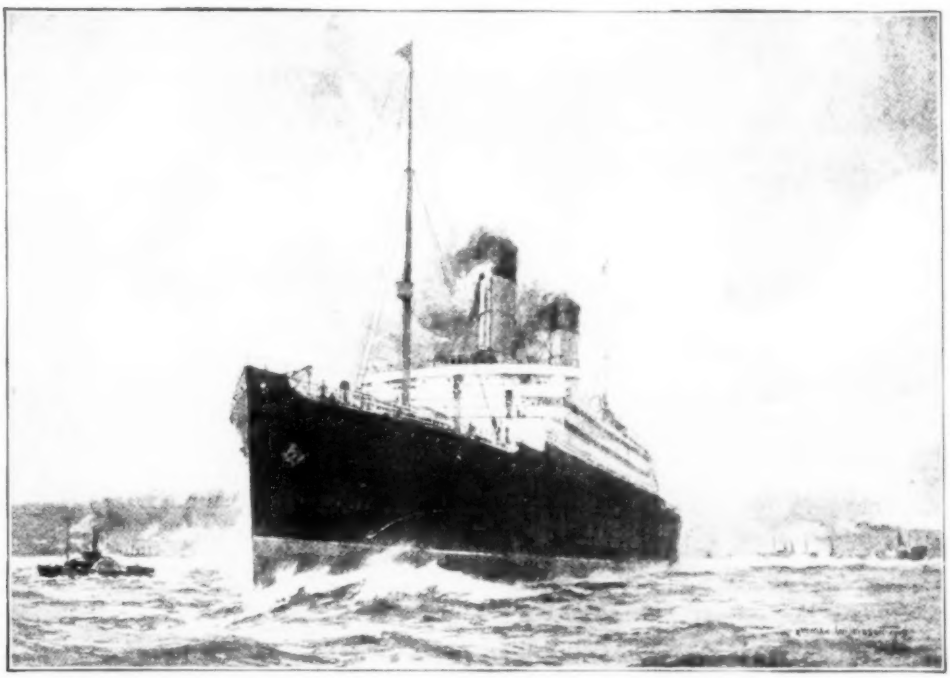
The remarkable claim is made of the discovery by a Nova Scotia blacksmith, of a process for hardening copper to such a degree that it will take an edge sufficient to be used as a razor.

American Consul Halloway, at Halifax, writes: "A razor has been made of the hardened copper with which one can shave. Having been made in a blacksmith shop the razor is necessarily crude, but the blade is hard and carries a sufficiently sharp edge to remove superfluous hair. The inventor says he can harden copper to any desired degree of hardness."

## PARCELS CARRIED BY STREET CARS.

Parcels are carried on the street cars in Manchester, England. The district covered has been divided into two districts, an inside zone including the city of Manchester, and an outside area including the suburbs; and parcels are delivered to all parts of the district covered at intervals not longer than 15 minutes. The charges are as follows: Inside area, parcels not exceeding 14 lb., 4 cents; 28 lb., 6 cents; 56 lb., 8 cents; 112 lb., 12 cents. For the outside area the prices for the same weights are, respectively, 6, 8, 12 and 16 cents. The "inside area" has a population of 800,000 people.

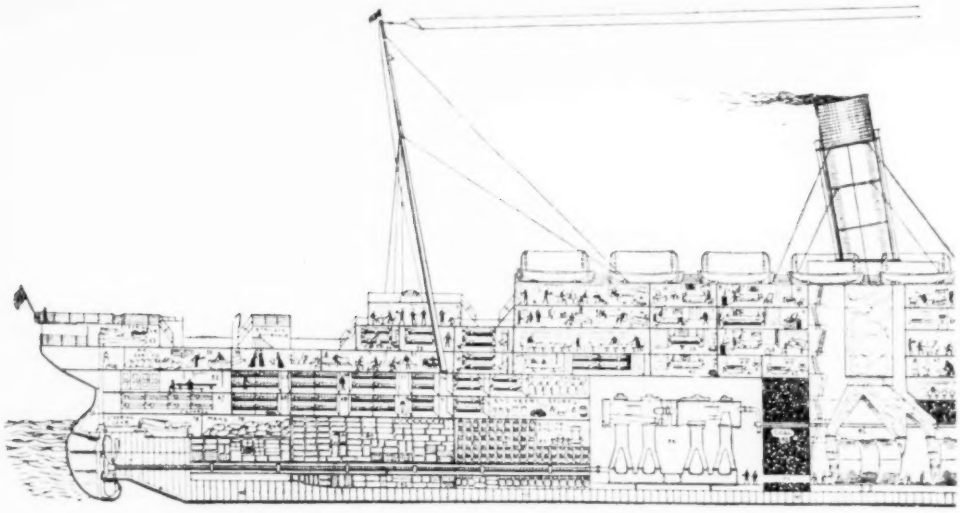
# The "Caronia" Now the Largest Vessel in the World



**S. S. "Caronia" Leaving Port on her First Trip**

Standards of size in the big liners that ply the seas change rapidly. But a short time ago the "Baltic" was announced as the "largest vessel in the world;" before the "Baltic" the "Cedric" and the "Celtic" together held the palm; now all of these are eclipsed in size by the huge Cunarder "Caronia," which has recently made her maiden trip across the Atlantic from Liverpool to New York.

The "Caronia" is a twin-screw vessel 675 ft. long, 72 ft. 6 in. breadth, of 30,000 tons displacement and having a speed of 19 knots—two knots speedier than the "Baltic." She has eight continuous decks, on six of which passengers are carried. The vessel is handsomely fitted up and has accommodations for 2,650 passengers, which, with a crew of 450, make a total of 3,100 persons she is able to carry.



**S. S. "Caronia"--Deck Rises Upon Deck**

In the construction of the vessel 12,000 tons of steel were used, a great number of the plates being 1⅛ in. thick, 32 ft. long and 5½ ft. wide and riveted with 1⅛ in. rivets, the riveting being done with hydraulic pressure. In all, 1,800,000 rivets were used.

The reciprocating engines used in the vessel are of great size and strength. The total height from the center of the shafts is 30 ft., and from the base of the bed plate 36 ft. The diameters of the respective cylinders are 39 in., 54½ in., 77 in. and 110 in. The latter, with one exception, is the largest cylinder yet adopted for vertical engines. The stroke is 5 ft. 6 in., and the length of the connecting rods is 12 ft. between centers.

The two engines are separated by no longitudinal bulkhead and make an impressive appearance when running at 90 revolutions.

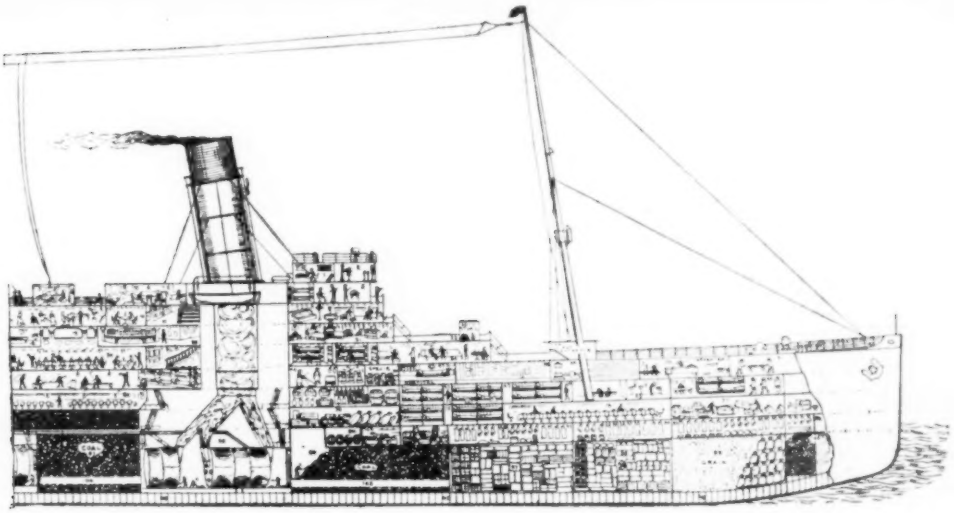
## THE CAPE COD CANAL.

The building of the canal from Buzzards Bay to Massachusetts Bay will soon be under way. This canal will traverse a distance of 7 1-3 miles together with approaches aggregating 4½ miles and will occupy more than three years in building. It will be constructed by the Boston, Cape Cod & New York Canal Company.

## HOW TO REPRODUCE PHOTOGRAPHS IN WATCH CASES.

Any workman accustomed to enameling can reproduce photographs on watch cases by following carefully the outlines of the process as given here.

Prepare the cap by coating with transparent frit so that it appears as if coated with transparent lacquer. The picture is produced by the "dusting in" or "powder" process. Take a good negative, the actual size the picture on the watch case is to be, and provide a piece of plate glass of suitable size. Rub the surface of the glass with pevdered talc, but leave none of the powder on the glass. Prepare a solution composed of 60 gr. of pure, clean bits of gum arabic; 45 gr. glucose; 10 mm. glycerine; 30 gr. bichromate of potash; 2 oz. distilled water. Mix, warm and filter through muslin. Flow a film of this mixture evenly over the plate glass and dry it in the dark. Expose the film-covered surface of the glass under the negative for a length of time which must be ascertained by experiment. Then carefully protect the coated glass from the action of light and take it to a cellar or some other place where the air is moist and it can absorb moisture in proportion to the action of the light. All portions screened from the light receive the most moisture, and these portions will best take and hold any dry powder brushed over the surface.



**Like the Stories of a Great Office Building**

No dust will adhere where the light has acted in full force.

For the dust use dial painter's black. This is intensely black glass ground to a powder so fine it is impalpable. Brush it dry over the face of the print with a camel's hair brush. Remove all particles except those which are held by the tacky surface. Very beautiful and perfect positive pictures are produced in this way.

To transfer the picture to the cap of the watch flow a coating of tough collodion over the picture on the glass and allow it to dry. Then separate the collodion film from the glass and wash away the coat of gum and dextrine. Place the positive picture, collodion side out, on the watch case and heat the cap in a muffle. The collodion will burn away and the black enamel pigment will fuse and incorporate itself with the transparent glaze on the watch cap.

## TORPEDO-BOAT DESTROYERS.

The torpedo-boat destroyer has made a great record in the present war. The Japan Times says: "The great service rendered by our torpedo-boat destroyers in the present war is almost incomparable, the successes attained in robbing the enemy of fully half of his moral and material strength in the very first engagement, in taking the principal part in the work of maintaining the blockade, and in making themselves the ears and eyes, hands and feet of the great fleet, in carrying out the reconnoissances, orderly and intelligence services—all these being placed to their credit."

The Asahi says: "The destroyer is a parent-excelling child born of the torpedo-gunboat as father and the torpedo-boat as mother, and as a late comer in the field she has yet had no opportunity of showing her worth until the present war, which has proved her wonderful capacities."

## TRAMWAY TRACKS 2,500 YEARS AGO.

The first railroad track was constructed by the Greeks as far back as 600 B. C., or 2,500 years ago. The tracks were constructed through the mountains on the road to the temple at Delphos and were to guide the wheels of the wagons bearing sacrifices and sacred vessels thither. Had an accident happened to the wagons en route it would have been an ill omen and a sign of the gods' displeasure, hence the tracks.

These tracks were two parallel grooves about 3 in. deep and 4 ft. 9 in. apart. The cart wheels traveled in the grooves which were cut with great precision. Parts of these tracks may still be seen in various localities in Greece.

## MOTORCYCLES FOR MAIL COLLECTION IN BUDAPESTH.

Mail collection by motorcycle is declared by the Austrian minister of posts and telegraphs to be a success both as to time and money-saving.

The motorcycle shown in the engraving has a hood to protect the mail from the

Courtesy Austrian Minister of Posts

**Postal Motor Tricycle**

weather and as it is in tricycle form it is easily managed by one man.

These vehicles, of which twenty-two were first installed, cost $380 each. The twenty-two tricycles make about 93,205 miles a year. The cost, as compared to the method of horse and wagon collection, shows a marked saving, and the gain in time is considerable.

The ministry has decided to further enlarge the service by increasing the number of both tricycle and quadricycle machines.

The collectors are required to clean their own machines, but repairs are conducted by skilled men employed by the department.

## "POP" ALL YOUR LIFE FOR $10

In response to several inquiries for the price of a life subscription to Popular Mechanics, the publishers announce the following liberal offer: On receipt of $10 we will send this magazine to any person for the remainder of his life. The address can be changed as often as desired.

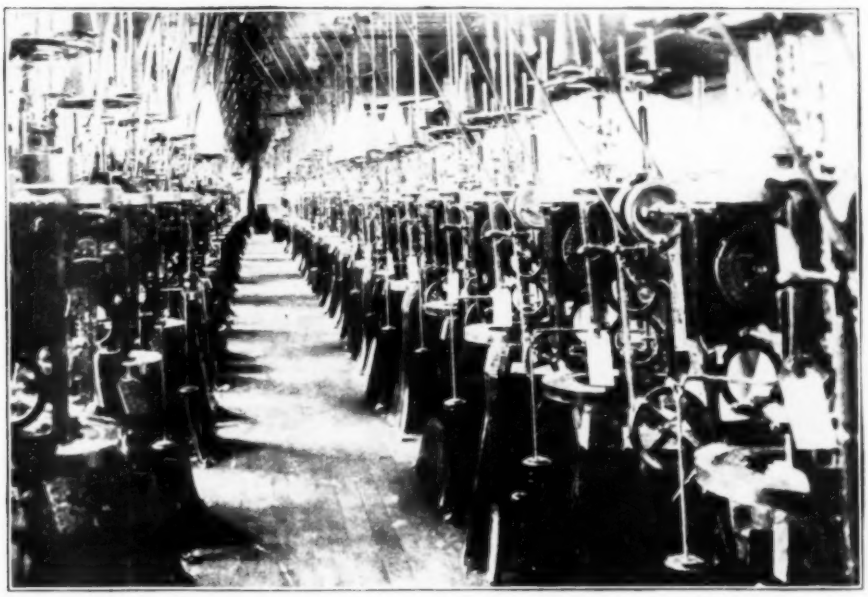
A life subscription makes a very acceptable present to any one.

## HOW COTTON UNDERWEAR IS KNIT.

Modern machinery nowadays enters into nearly every department of the making of cotton underwear, from the winding of the yarn upon cones to the actual knitting of the goods and the cutting of the finished cloth. The yarn arrives at the knitting mills in car loads and is stored in a house built especially for the purpose. If not already on cones it is taken to the large winding machines and placed in charge of an operator who is capable of handling forty cones. The yarn is then ready for the knitting machines, one operator being in charge of four machines.

These knitting machines are almost human in their activities, 800 to 1,000 needles working at once from eight to sixteen bobbins and automatically changing the style of the work as it knits a cuff and then the full width of the sleeve. It is a system of both horizontal and perpendicular needles. Some of the machines are used for the knitting of sleeves and others knit the cloth for the body of the garment. The machines can be so adjusted as to knit either union suits or separate piece suits and the same machines are gauged to the many different sizes of all

**Where Parts of Garments are Assembled and Seamed**



**Automatic Knitting Machines**

garments. The cloth comes from these machines in a long seamless webb. In one of the accompanying photographs fifty knitting machines are shown.

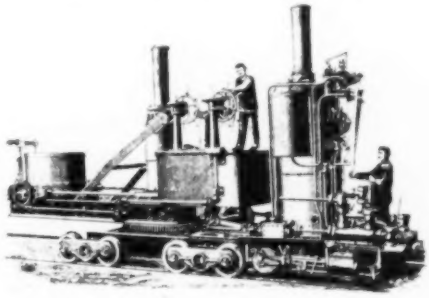
After the cloth comes from these machines it next goes to a reversing machine at which the long strips are turned inside out ready for the fleece lining process, which is accomplished by means of two kinds of rollers alternated, one of wires laid slanting and others standing straight. Some of the finer grades of goods are not fleeced. There is a reversing machine for the sleeves and another for the body of the garment.

The long webbs of cloth are next cut up into the parts for separate garments by means of an electrical machine which will cut twenty-four thicknesses at one time. There are some kinds of garments, however, which have to be cut by hand. Once cut into the desired lengths they go to the sewing machine girls who put them together, after which the seams are smoothed out by machinery. The garment is now ready for the finishing touches such as the crocheting of the edges, the making of the button holes and the sewing on of the buttons. The subsequent operation of pressing is done upon a large machine equipped with successive iron plates which in some instances are heated and in others are not.

"Shop Notes for 1905" will interest you. Contains kinks for every craft. Price 50c.

## FRENCH CRANE AND LADLE.

A French builder has constructed a new type of combined locomotive, crane and ladle for use in a Bessemer plant. The power is steam generated in two upright boilers on the car. One set of cylinders



**Ladle Crane for Steel Works**

propel the car; another set work the crane through the medium of hydraulic power. Two men are necessary to the operation of the machine, one to run the car and one to operate the crane and ladle.

Diamonds, a great wealth of them, may be hidden in that part of Canada between the Great Lakes and Hudson Bay, declares Dr. Ami of the Canadian geological survey. Surveying parties and explorers are instructed to be on the look-out for any traces of the gems.

## KITE FLYING FOR BUSINESS, PLEASURE AND LIFE SAVING

### Day and Night Sky Signs Handbills Distributed in Mid-Air Progress of the Art

By Edward E. Harbert

Kite flying is no longer boy's play; it is a business; and a business in which the compensation is not only dollars, but precious human lives.

I was an electrician in Chicago at the time I first began to study kites and their operation, and was led to do so on account of the numerous skyscrapers. For many years I ran wires for telegraph and other purposes in all parts of the business district. It was hard enough work at any time, but when

**Harbert and His Kite**

the fifteen and twenty-story skyscrapers sprung up, our difficulties were immediately multiplied. One day after all other means had failed to get a wire between two very inaccessible points, I rigged a kite and in a few minutes accomplished what ten hours hard and extremely dangerous work had failed to accomplish. After that I used kites right along, and became so interested in their possibilities I finally devoted my entire time to the work.

The kite subject commanded almost as much interest at the St. Louis fair as the balloons although the press of the country paid little attention to the contests. In this connection it is interesting to note that the first and second cash prizes for kite work were awarded to one other mechanic and myself against the "professional" kite fliers, men whose names are well known in this and other aerial work. In one of my demonstrations there I maintained for longer than the specified time, a kite at an angle of 45 deg., with 1,500 feet elevation.

After experimenting with all the many types of kites I prefer a flat kite, something like the Malay, of a size 6 ft. high and 6 ft. wide, and without a tail. This shape kite can be worked tailless by making two pockets with holes in each, and placing one on both sides of the backbone and above the cross-stick. The covering I prefer is bearsilk, but any similar material will answer. The kite complete, including the two sticks, weighs only 1 lb., and is collapsible, folding into a space 3 ft. long and 3 ft. wide. One of these kites will, in only a light wind, carry up a ball of strong cord 1,500 ft. long, which can be dropped at any desired moment over a point 2,000 ft. distant from the kite operator. I have repeatedly demonstrated the effectiveness of this device (see Fig. 1) as a means of carrying a line from a lake steamer to the shore.

For heavier work fly your kites in tandem at distances of 500 ft. apart. With five such kites in tandem, and using a correspondingly heavy kite line, a body weighing 60 lbs. can be carried to a height of one mile and maintained there as long as the wind holds. For this work a securely anchored windlass is necessary to let out and take in the kite line which must be the size of a small clothes line.

I believe the time will come when every vessel and every life-saving station will be supplied with a kite outfit for passing a line between the shore and stranded vessel. Usually in near shore wrecks the wind is toward the land, making it very easy to carry a cord to shore, which establishes connection between the two. A heavier line and finally a life line can then be drawn to the vessel. If the wind is off shore the same result can be had, but requires a little more time, as a vessel a half-mile out is a comparatively small mark in a gale; but it can be done.

The commercial side of the work lies at present more in the nature of sky signs, which are becoming more general each year. A bright banner 30 to 50 feet long, floated a thousand feet or more above a place of business, and announcing special sales, openings, etc., never fails to attract attention. The air is free, there is abundance of room, and the expense is not great. In some cities

professional kite fliers are making time contracts for this work, the charges being so much per hour while the banner is in suspension. For night work specially built searchlights are used to "spot" the banners, thus bringing the words out in bold relief.

A recent novelty is the wholesale distribution of hand bills or circulars which are sent

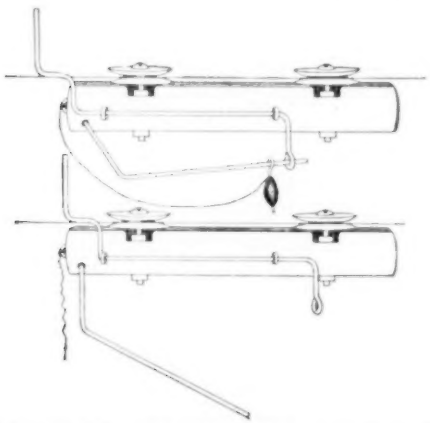


**Fig. 1--Two Views: Upper Closed; Lower Open and Ball Released. Device is Fastened on Line Near Kite.**

up and released where and as often as desired. The distance these announcements will travel when dropped from a height of a thousand or more feet is surprising. The same apparatus by which this is done can be used to work the shutter of a camera. The device is very simple and will, I think, be understood from the illustration, and can easily be made by anyone.

There are two ways to release in mid-air. In Fig. 1 two views are shown of the same device. The upper view shows a device to

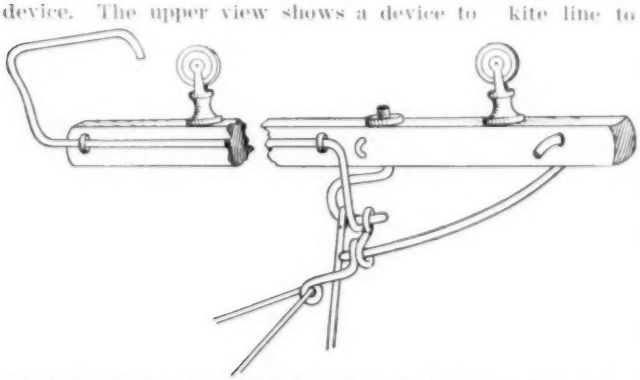


**Fig. 2--Tripping Mechanism of the "Traveler." This is a Part of the Device (but without the Wings) Shown in Fig. 3.**

be fastened to the kite by giving the kite line a turn around the two buttons. The device should be attached when say from 200 to 500 ft. of the kite line has been let out. The sketch shows the manner of attaching something to be released later on. A ball of twine for instance, such as would be used in flying a line from ship to shore. In the sketch the size of the ball is made very much smaller in proportion in order to leave room to show the arrangement. In the lower part of Fig. 1, the wire has been released, the ball has dropped, unwinding as it fell, and one end remains fastened to the device which is in turn fastened on the kite line. Instead of a ball of twine a package of bills could be hung and released in the same way.

The release is effected by a "traveller" or

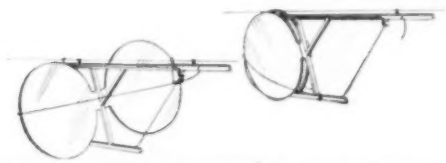


**Fig. 3--The "Traveler." Wings as Open to Ascend on Kite Line; Wings as Closed to Return to Operator.**

trolley shown in Fig. 2 and Fig. 3, which runs on the kite line suspended from the two small grooved wheels shown in Fig. 2. The two wings carry the traveller up until it strikes the trip in Fig. 1, when it releases the burden carried by Fig. 1, and at the same time works the trip in Fig. 2. This allows Fig. 2 to drop anything which it may carry, and also lets the two wings close on their hinges, when the traveler, no longer offering any resistance to the wind, slides down the kite line to the operator. It can then be loaded and sent aloft, the operation being repeated indefinitely.

The traveler as well as the device shown in Fig. 1 is made of light wood and pieces of ordinarily stiff steel wire which anyone can bend with a pair of pincers.

As an outdoor recreation, kite flying is one of the most fascinating and inexpensive of sports, and when once a person takes it up he is surprised to find how much there is to it, and how great are its possibilities.

## THE ENGINEER'S CAB ON SOME EUROPEAN RAILWAY LINES.

The American engineer in his cosy cab, protected from the fierce elements and sufficiently comfortable that his mind need not dwell on the requirements of his body, but

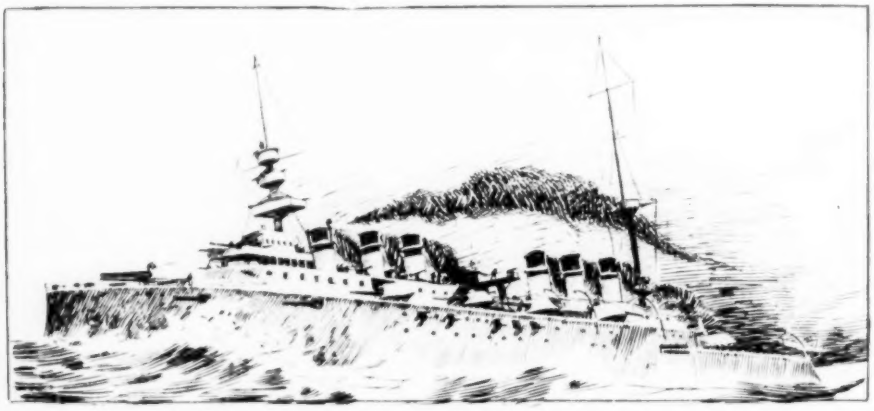
**"Engineer and Stoker are Exposed to the Lashing Rain"**

is free to concentrate itself on the control of his iron steed, the perspective of glimmering rails ahead, and the signals he must watch for, is far better off than many of his brother engineers on European lines. The illustration shows the cab of a locomotive which hauls a fast express between Calais and Paris, France. Only in recent years has the protection for stoker and engineer been even so much as shown. As it is they are exposed to the lashing rain and sleet. The other occupants of the cab are Prince Ferdinand of Bulgaria, and M. Morizot, the chief engineer of the line.

The potter's wheel is probably the most ancient of mechanical devices. In China and Japan a simple form, differing but little from that used in Egypt 4,000 years ago, is still used for shaping porcelain ware.

## NEW FRENCH CRUISER OF 40,000 HORSEPOWER.

There will soon be launched in the shipyards at St. Nazaire, France, the French armored cruiser "Ernest Renan." Though the length and displacement of this vessel is but little in excess of many of the cruiser type now being built here and abroad, its horsepower is enormous, indicating 40,000. The ship is 515 ft. long, 72-ft. beam, with a draught of 27 ft. and a displacement of 13,644 tons. The armor belt is 12¼ ft. wide and 6¾ in. in thickness, and the ship is designed for a coal capacity of 2,300 tons. A comparison with our own cruiser Washington, the keel of which was laid in 1903, will be instructive. This vessel is 502 ft. in length, 73-ft. beam, with a draught of 26½ ft., and a displacement of 14,500 tons. But its coal capacity will not exceed two thousand tons and it will indicate only 23,000 horsepower.



**This Cruiser Has 40,000 Horsepower**

# Motor Iceboating The Coming Winter Sport

## Speed of 100 Miles and More an Hour--New and Exciting Sport for Winter Months to Replace Autos and Launches

**This Boat Made Over 40 Miles an Hour**

Over the frozen waters of the lake it speeds—the wonderful iceboat of the winter of 1905-06. It started from the shore with a careful calculating motion, as though it would measure the course whereon its powers were to be displayed. With a gliding spring it rose easily over the bumps and ridges of ice near the shore and then, with a sudden acceleration of speed, made its way out on the glittering, fascinating sea of glass. Faster and faster it goes, and its course is as steady as the flight of a homing dove. A giddy ice-yacht with a cumbersome spread of sails is just ahead, and its course is uncertain, depending on the freak of the wind, but the iceboat, under perfect control, steers clear of the yacht, and flies past like a meteor impelled of some celestial sphere. The occupants of the two vessels call out a gay greeting, but the iceboat is gone so quickly that only the wind catches the full intent of the words. From a speed of 40 miles the number has increased to 50—75—and even 90 miles an hour. The eyes of the driver are fixed on the little mechanism that records the speed. Steadily—surely—it increases, until at last the little indicator has reached the 100-mile point and remains there without a flicker.

Undoubtedly, iceboating is the coming winter sport. During the past winter hardly a man or boy, near a frozen body of water of any size, in either this country or Canada, who did not try to rig up and use some form of ice-craft. Many of these were successful, and the records made on the northern lakes and rivers with ice-yachts were surprising. Now, however, comes the motor iceboat, the invention of F. M. Underwood, of Toledo, Ohio, and promises to eclipse all precedent in the sport. The experiments were taken up too late to be carried out entire during the past winter, but the first boat successfully constructed made a speed of 40 miles an hour, demonstrating that the principles were alright and that, with some changes and greater power, a boat capable of making 100 miles an hour was easily possible.

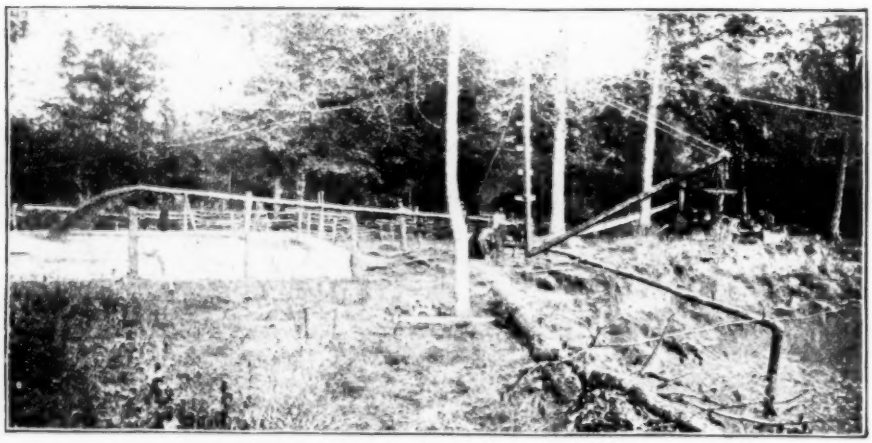
The craft illustrated was not completed until late this spring and only a few opportunities to use it were possible before the ice on Lake Erie became unsafe. This was a great disappointment and Commodore

Underwood (for he is commodore of the Toledo Yacht Club) is impatiently waiting the return of another winter. The boat is 12 ft. long, 40 in. wide at the bow, tapering to a sharp point at the stern. The runners are sheet steel. The steering runner is controlled by a tiller and works the same as on a sail boat. The sheet steel or dashboard is to protect the machinery and passengers from deadly blows from pieces of ice which fly up from time to time, for meeting a nice bright chunk of ice at 40 miles an hour is not at all desirable. The engine is set cross-wise in the boat instead of the line shaft running fore and aft as in a propeller launch. The driving wheel is of steel, 36 in. in diameter, with 12 spokes, the face of the wheel being 2 in., set with 96 sharp pointed spikes 1 in. high. These spikes are not placed directly opposite each other, but are "staggered," which gives a better hold. The driving wheel is hung in a V shaped frame, the two open ends being hinged securely at a point opposite the engine shaft. The other ends unite and are fastened to a strong vertical spring which holds the wheel firmly to the ice, but at the same time is sufficiently yielding to allow the driver to ride over reasonably large obstructions without danger of breaking it or upsetting the boat. The locking lever operates a clutch, which throws the driving chain in and out of action at will.

The entire construction will be so readily understood from the above description and the illustration that our readers will have no difficulty in constructing a motor ice-boat in good season for next winter, and those who already own either an auto or a small launch can remove their engines from the summer service and install the same power in a winter craft.

The new boat now under construction will differ from the other in that it will have two drive wheels, one on each side, and be equipped with a four-cylinder 10-h.p. gasoline engine. Power will be transmitted by a regular automobile chain and an automatic spring on the runners will cause them to raise, should the boat strike an open sheet of water or weak ice, without the attention of the driver. The boat will thus ride over the spot without injury to either machine or occupants.

## Gravel Pumped Like Water



**This Plant Will Lift 100 Yards of Gravel a Day**

Pumping gravel like water through a large iron pipe may seem a strange and unique proceeding, but this is what is actually being done in certain districts in Indiana. Great difficulty has always been experienced in obtaining gravel from river beds for use in road building, but the new method promises to put an end to this. A six-inch pump is used, driven by a 15 h. p. engine, and three men are necessary for its operation. A plant of this kind has a capacity of lifting over 100 yards of gravel a day.

# Remarkable Success of the Cleveland Rolling Road

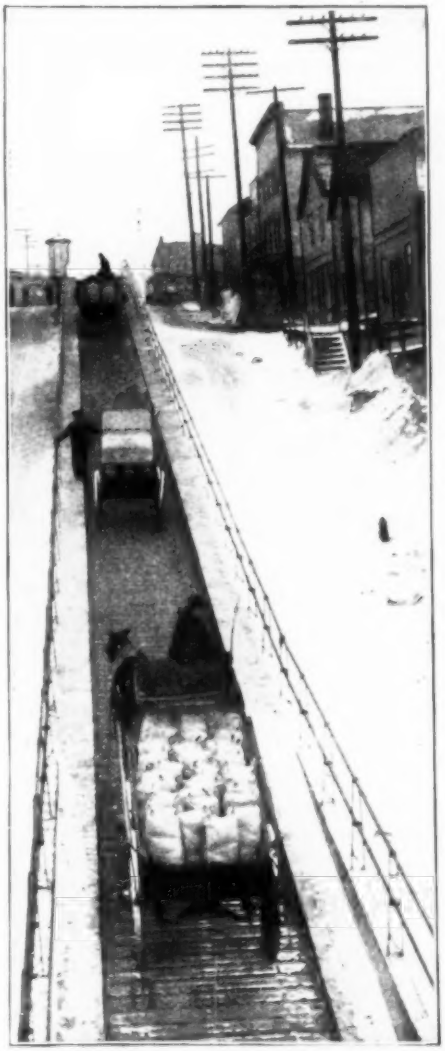
A moving roadway ascending a steep hill at the rate of four miles an hour and bearing with it heavily laden teams and vehicles of all kinds, is the sight which now greets the astonished visitor to Cleveland, Ohio. Moving sidewalks have been much talked of and experimented with, but it has remained for engineers of that city to successfully apply the principles of their construction to a roadway and put it into every day use.

This rolling road, as it is called, is 420 ft. long and rises 65 ft. in that distance, the ground traversed being a steep incline in Factory street hitherto shunned by all teamsters because of the difficulties of its ascent. But these have now been overcome by this novel invention. The heaviest loads are driven on to the rolling road at its lower end, the huge belt is set in motion, and in three minutes the team has reached the top of the hill without any effort on the part of the horses.

The roadway consists of a long moving platform eight feet wide made up of heavy boards arranged crosswise and divided into trucks of two boards each to give pliability to the structure. These boards are metal bound and are fastened together with metal links. The belt so formed is extremely heavy, weighing 99 tons, and turns upon a drum at each end rotated by means of chains and sprockets, there being several idlers to support the roadway as it returns on the underside. Two safety cables extend the entire length of the belt and at short intervals links pass up through the road from them to which the wagons are clamped to prevent their slipping. The road is operated by four electric motors controlled from a cabin at the summit.

The rolling road is equipped with sufficient power to carry all the wagons which can be driven upon it at one time and its average daily capacity is estimated at 600 vehicles per day. The charge for transportation varies from ten to twenty-five cents per trip, depending upon the kind of vehicle and the loading, and as the use of the road means a saving of fully fifty minutes in time to the teams of the surrounding warehouses it will not want for patronage. Passengers are also carried at the rate of two cents per person.

This roadway has proved so great a success that Col. Isaac Smead is now engaged in designing a more elaborate structure which will be operated over a viaduct specially constructed for the purpose in another hilly street in Cleveland.

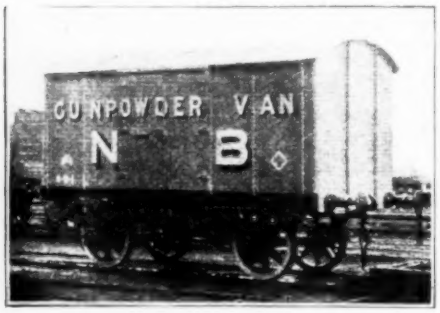


**Easy to Mount the Steep Grade**

An electric elevator is soon to be installed in the grand Cathedral at Berlin, for the exclusive use of the German emperor. An elevator in a church is quite unusual, but a private elevator is even more of a novelty.

## GUNPOWDER VAN USED IN ENGLAND.

In conveying gunpowder and other explosives the great risk assumed by the railway makes it imperative that the means of conveying it be perfectly adapted to the purpose. Our illustration shows a 7-ton gunpowder van, which the Locomotive Magazine, London, says is used on the North British Railway.




**For Conveying Gunpowder**

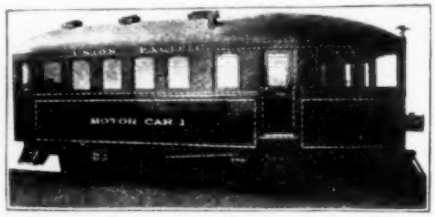
The inside dimensions of the car are length, 15 ft. 8 in.; width, 7 ft. 1½ in.; height 6 ft. 3⅜ in.; the wheelbase is 9 ft. and the distance from the rails to body is 3 ft. 1 in. The underframe and axles are of steel, the wheels of wrought-iron and the body and roof are built of mild steel plates, angles and tees. Inside, the body is wood, cased with yellow pine boards. These are secured with brass screws without projections. To a height of 2 ft. above the floor the doors, sides and ends are lined with lead sheets fastened with flat-headed copper nails to the wood casing, all joints being soldered.

The locks, hinges and bottom fastenings of the doors are of brass and the hinges and socket for the top door fastening are secured with brass bolts. Thus no iron or steel part comes in contact with any other part made of these metals and wherever iron or steel work comes in contact with wood it is well coated with white lead oil paint. Thus there is hardly a chance by which a spark of fire could be emitted by friction. The van is painted vermilion, varnished, has no ventilators and is absolutely dust-proof.

## SELF-PROPELLED RAILWAY PASSENGER COACHES.

Single passenger coaches speeding across our prairies and hills, from city to city and supplanting the arrogant locomotive almost entirely for local passenger service, may be the next great innovation in railway motive power departments. Railway engineers all over the country are turning their attention to the possibilities of the internal combustion motor for directly driving passenger coaches and thus doing away with locomotive, smoke and dirty coal tender, and meaning as well a reduction in labor.

A passenger coach designed along these lines and directly driven by a gasoline motor has been built at the Omaha shops of the Union Pacific railroad and will be used for local passenger service at Portland, Ore. This is the first serious test of the kind. The coach, which has seating capacity for 25 persons, is mounted on specially designed trucks, having 42-in. wheels and the construction of the whole is very strong. The roof is fitted with ventilators and the floor is watertight, so that it can be flooded and cleaned readily. Acetylene gas is used for illumination, and an acetylene headlight is




**Requires No Locomotive**

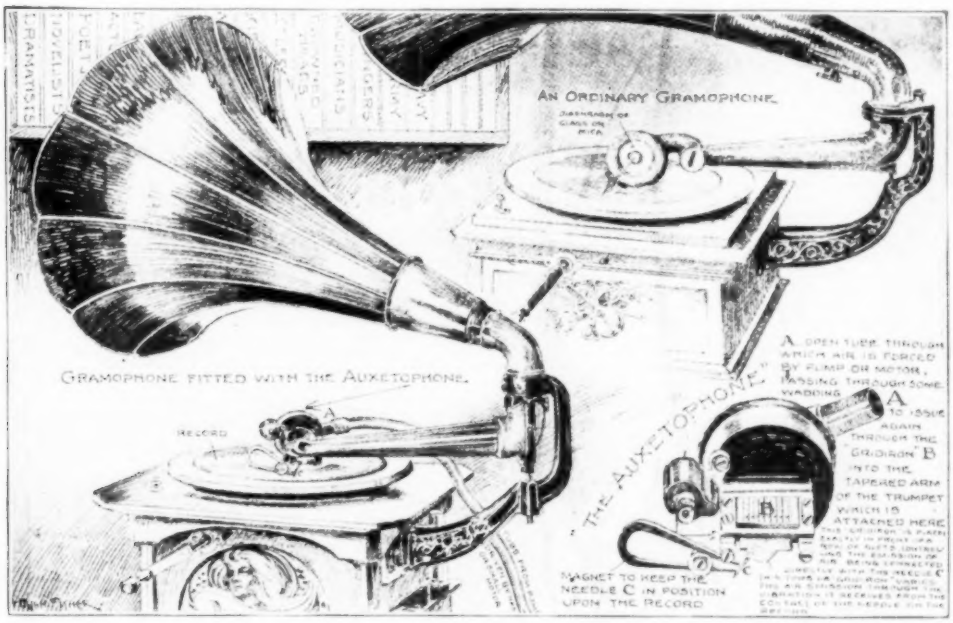
mounted at the front of the car. The coach is shaped to offer the least resistance possible. The car is heated by a system of piping which is arranged to cool the jacket water of the motor also. The motor supplies power for a speed of 40 miles an hour. Compressed air is used for starting the car, handling the brakes, opening and shutting the doors and lowering and raising the step from the driver's compartment. This step arrangement keeps passengers from alighting before the car has stopped and so prevents accidents.

**POPULAR MECHANICS balance of your life for $10.00**
**POPULAR MECHANICS five years, only . . $3.00**

# "Auxetophone" Makes Open-Air Concerts With the Gramophone Possible

Before the summer is over, the people who throng to our parks and summer pleasure resorts of evenings may be privileged to hear the voices of all the great singers of the world and the finest orchestral productions, as well as the voices and words of many great and distinguished persons they may never chance to see. All this is to be brought about—not by the much maligned phonograph—but by the gramophone fitted up with a special attachment called an "auxetophone" which increases the volume of the gramophone and enables it to sound as loud as a full brass band in the open air, says the Illustrated London News.

The auxetophone is the invention of the Hon. Charles Parsons and consists of a "gridiron" or "comb" which is attached at the small end of the tapered arm of the trumpet. Air is forced by a pump or motor through an open tube, A, extending from the gridiron and passes through some wadding. The emission of this air from the ridiron is controlled by a row of slots exactly in front of which the gridiron is placed. The needle, C, which is held in place by a magnet as indicated, is connected directly with the gridiron, and so the air emission varies with the vibration the gridiron receives from the contact of the needle on the record. The apparatus is very simple and, it is said, wholly successful. A library of the voices of famous people is being made up by the controlling company and will be offered to the British Museum.


AN ORDINARY GRAMOPHONE
GRAMOPHONE FITTED WITH THE AUXETOPHONE
RECORD
THE AUXETOPHONE
MAGNET TO KEEP THE NEEDLE C IN POSITION UPON THE RECORD

**"This Attachment Enables the Gramophone to Sound as Loud as a Full Brass Band."**

## HOW SPIRIT PORTRAITS ARE PAINTED BY GHOSTS.

A recent exposé of fraudulent spiritualistic mediums brought out the interesting details of the process by which "ghosts" paint "spirit portraits."

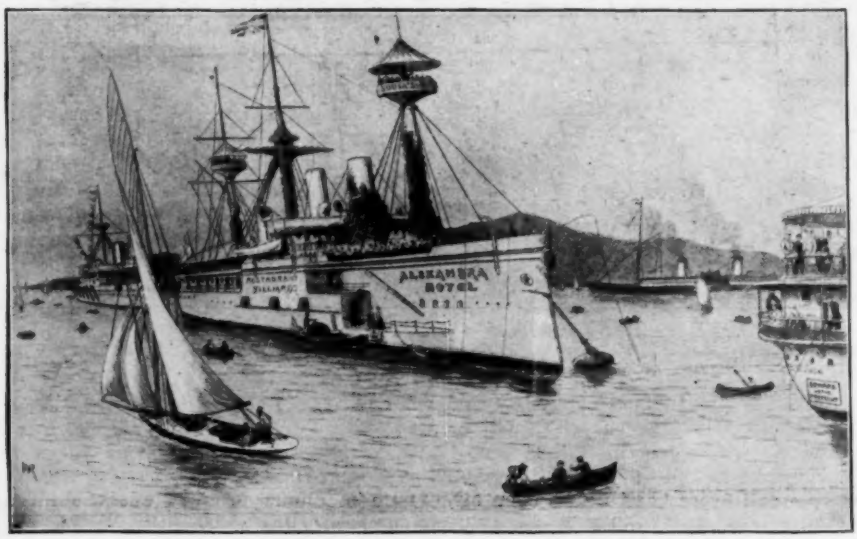
The patron or "sitter" who desires to have painted the portrait of a departed friend is received in the sitting room on an upper floor; on the floor below is stationed the ghost—an expert photographer. A photograph of the dead person is given by the sitter to the first medium, who wraps it in several folds of tissue paper—so there will be no chance of fraud—and passes it over her brow. As she does so a series of raps

begins to sound on the table near the second medium. These raps are made by the thumb nail of the second medium, but the sitter cannot detect it. Naturally the sitter turns to No. 2, who declares she is in communication with the spirit and tells the sitter to put his hands on the table to establish the current. The duty of No. 2 now is to hold the sitter's attention. While No. 2 is thus engaged No. 1 drops the photograph through a slit in the floor near her, to the "ghost" below. The "ghost" makes a negative of the photo, rewraps it in the tissue and passes it back to the medium. It is done in less than two minutes. There are more messages and finally the spirit—the model of the painting—is there. Through the medium the spirit bids the sitter come again Thursday as he cannot get into communication at the present time.

In the interval between the next sitting the "ghost" makes an enlargement of the photograph on sensitized canvas, paints it over and also makes ready a blank canvas exactly like the canvas on which the portrait is made.

When the sitter comes back communication with the spirit is again established. The blank canvas wrapped in tissue paper is set up in the window. Medium No. 2 again holds the sitter's attention with fraud messages, and while she does No. 1 substitutes the completed portrait for the blank canvas. When the sitter turns the painting shows dimly through the folds of tissue. Again and again No. 2 holds his attention by conversing with the spirit—and each time he turns the picture shows brighter—successive layers of tissue having been torn off in the meantime by No. 1. At last all the remaining paper is torn off and there is revealed a perfect portrait of a spirit painted by a spirit. Of course the sitter is willing enough to pay a good price for such a wonderful manifestation.

## Warships Converted Into Gay Floating Hotels




**The Transformed Battleships Would Look Like This**

Floating hotels—a whole flotilla of them—decked with gay streamers, fitted up with every accommodation that would appeal to lovers of the deep and anchored in the beautiful Kyles of Bute. This is the picture conjured up by an English artist who has suggested to the British admiralty the plan of converting their disabled battleships into floating hotels, and so create a new, and in all probability, profitable source of revenue, instead of selling the ships for a nominal sum.

The artist suggests converting the fighting top into a band stand, training vines up the masts and many other attractive features. The plan would afford a delightful means of spending a summer outing and would doubtless be highly popular.

# Machine for Writing Shorthand

**French Invention Which May Revolutionize Present System of Learning Shorthand**

Shorthand can now be written on a machine. For many years there have been attempts made to construct a machine for this purpose, and while several inventions have been made and put upon trial they have not come into general use. However, a Frenchman, M. Bivort by name, has recently brought out a machine which he calls the stenophile and which promises to be of the greatest value, inasmuch as it is capable of practical use for all business purposes and is qualified to supplant the present method of writing shorthand by hand.

Recognizing the necessity of having a rational alphabet which would contain the greatest number of sounds in the fewest signs, M. Bivort has designed an alphabet in which all similar consonant sounds are consolidated, and has constructed a system of syllabic writing by means of which the operator is enabled to attain the speed of shorthand writers of to-day. Following the phonetic principles used in present systems he has combined several of the consonants, such as B and P, F and V, T and D, etc., thus reducing the number of keys necessary to twenty, ten for each hand. There are two intermediate keys, one for the aspirate H, while the other moves the paper forward. An accessory key moves the carriage for the writing of numbers and signs much on the order of the upper case key in the single keyboard typewriters. In appearance and general plan of construction the stenophile is very similar to a small typewriter, but the arrangement for holding and feeding the paper is manifestly different, it being placed on the machine in a large roll and gradually unwound from one spool to another.

The speed of the machine rests, of course, upon the skill of the operator, but however rapid the action the legibility of the writing is unimpaired. It is claimed that with a week's practice an average pupil can write fifty words a minute from dictation, and that at the end of two or three months he will easily attain a speed of from 125 to 150 words a minute, the speed of the competent business stenographer of to-day.

One of the greatest difficulties with shorthand as now written is that the writer is usually the only one capable of reading his notes, and if he is hard pressed the rapidity of his writing distorts the characters so much that he himself often experiences difficulty in their transcription. By the use of the stenophile this difficulty is removed. The characters as written are constant in form and are easily transcribed by all who understand the basis of the system, so that one person may be employed in doing nothing but taking speeches or letters, as the case may be, and others in transcribing them.

**Taking Notes in Shorthand by Machine**

The stenophile so far has only been applied to the French language, but it is easily applicable to all others, and we may expect to see it introduced into business houses all over the world as a companion to the typewriter in the near future.

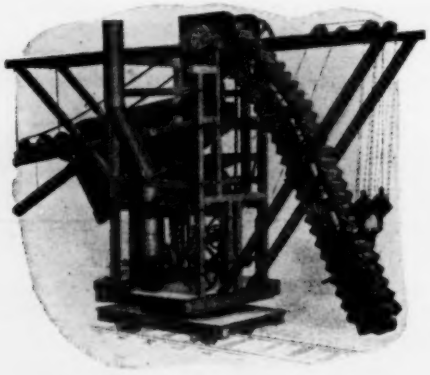
## PRESIDENT TO USE WIRELESS ON HUNTING TRIP.

President Roosevelt, while on his hunting trip in Colorado will keep in touch wth Secretary Loeb and his official staff at Glenwood, Col., by means of wireless telegraphy. Two expert signal service corps telegraph operators will accompany the hunting party. The field outfit will be conveyed by an army automobile as far as possible and then transferred to the backs of horses.

## GRAVEL ELEVATING AND SCREENING MACHINE.

For handling gravel the outfit shown in the illustration is most efficient. It digs the sand and gravel from the loose bank, elevates and screens it so as to give two products, casting all large stones or tailings off on the ground beside it.

The outfit consists of an elevator and



**Elevates and Screens Gravel**

revolving screen mounted on a flat car. The elevator is composed of buckets mounted on an endless chain. It is placed to one side of the car and extends 2 in. below the track level and projects 6 in. in front of the car. In operation the car is run directly to the face of the bank and a man stationed at the top of the bank can easily keep the elevator supplied with the loose material. The gravel is spouted from the elevator to the revolving screen in the center of the car, where the smallest of it falls through a fine wire screen, thus separating the sand. This screen is set at an angle and all that will not pass through it falls by gravity to a second wire screen of larger mesh. The gravel passes through this screen and the tailings fall over the end and are spouted to the ground.

The sand and gravel are discharged by belt conveyers from the machine into two dump cars placed alongside. The machine is driven by steam power generated on the car.

We want one live representative in every manufacturing plant in the United States and Canada, and pay very liberally. Write for full details of what others are doing. We believe you will be surprised to learn how much money you can earn during noon hours.

## AERIAL YACHT DUMONT'S LATEST.

"My aerial yacht," says Santos-Dumont, "will soon start on its first cruise. Beneath the egg-shaped balloon, slightly less elongated than my No. 9, will be seen hanging what looks like a little house with a balcony window running half its length on each side. The balcony window will be the observation room of the floating house, and in it the motor will have place. Behind it is a closed sleeping room, while in front you will see an open platform holding the steam producing boiler. Steam can also be led by means of a pipe to the open room for cooking and the closed room for heating purposes.

"As the floating house is designed to remain for days at a time in the air, protection from cold may become important; therefore the closed room can be made quite tight to retain the heat. It is like a whole car composed of a framework of pipe, aluminum and wire tightly covered with varnished balloon silk of many thicknesses. It will contain two cot beds, in which my guests may remain at ease."

Santos-Dumont foretells that the airship will be a successful opponent of the submarine boat.

## $350 OFFERED IN PRIZES.

Many of our readers will be interested in the handsome prize offers made by the Engineering News Publishing Co., 220 Broadway, New York, for the two best papers on the "Manufacture of Concrete Blocks and Their Use in Building Construction." The first prize will be $250, the second $100. The conditions of the competition are as follows:

Paper must not contain less than 5000 words nor more than 10,000; it must be typewritten, and must be received at the New York office of the company not later than July 31, 1905. The paper must be signed with some nom de plume and be accompanied by a sealed envelope containing the name and address of the author and marked on the outside with the nom de plume signed to the paper. It may be accompanied by any photographs or drawings the author thinks necessary for its illustration. Manuscripts and accompanying matter must be sent by express prepaid or registered mail. The outside of the package should be marked "For the Concrete Prize Competition."

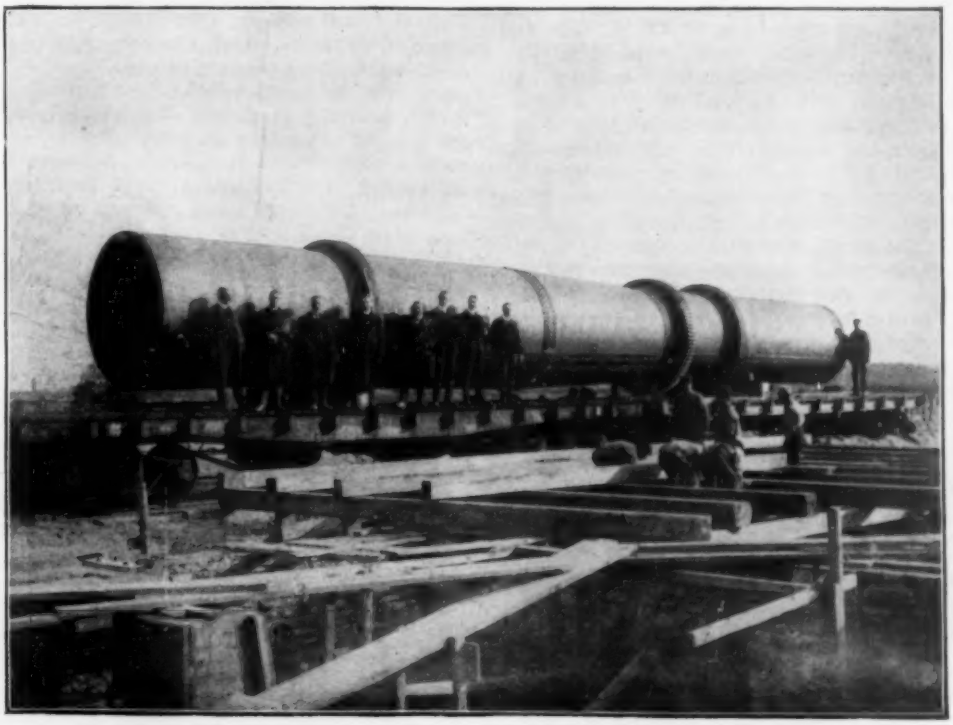
# How Portland Cement is Manufactured

## Huge Rolls Crush 5-Ton Rocks—Rotary Kilns 150 Feet Long—How the Fuel is Pulverized

A large plant for the manufacture of Portland cement has recently been completed and put in operation at Hull, P. Q., Canada, just opposite Ottawa, where there is abundance of the necessary raw materials. The plant has a capacity for 2,500 bbl. of cement per day, and involves a number of new features. An electric cableway, with a 1,200 ft. span, is used for conveying the raw materials from the quarry to the crushing house, and the machinery throughout the plant is electrically driven by powerful motors. The process of manufacture employed is known as the dry process, and involves the use of huge rotary kilns for burning the cement. Each of these kilns, in this instance, weighs 150 tons. The stone crushers of the plant will crush about 175 tons per hour.

The process through which the raw materials, commonly cement rock and limestone, pass in the manufacture of Portland cement in a large modern plant, is unique and interesting in the extreme. The two materials are found close together and loosened largely by blasting, though much of the material is so soft it can be shoveled out by steam shovels working on a railway. From the electric cableway the loaded skip is lowered into the crushing house to a platform, 50 ft. or more above the floor and opposite the mouth of the hopper, above the main crushing roll. The contents of the skip are discharged into the hopper by electric power, and the empty skip returned to the quarry.

In one typical plant of the kind the first pair of crushing rolls are 5 ft in diameter and 5 ft. long, and have crusher faces of cast-iron plates covered with projecting lugs. These rolls are capable of crushing a single rock weighing five tons. The speed of the crushers is about 250 revolutions per minute.



**One of the 150-Ton Kilns Loaded on Flat Cars**

**The Electric Cableway**

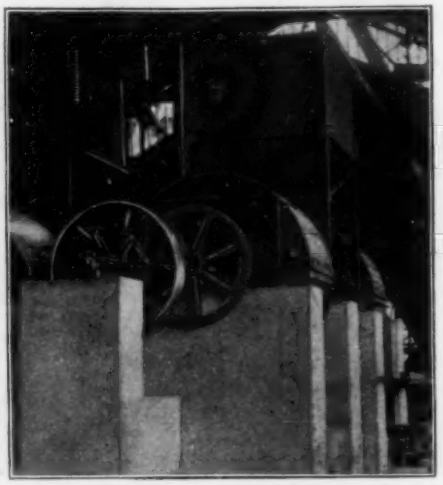
From these huge rolls the crushed rock drops into a 10-ton hopper below, whence it is fed through three sets of 36 in. rolls and passes through the last set reduced to ½ in. and less in size. On being screened all tailings from the crushed rock are returned to the crushing house and recrushed.

From the lowest set of rails the crushed rock drops through a chute upon a 24-in. belt conveyor, which carries it upward, at a speed of 500 ft. per minute (the speed of all the conveyors at this plant), to the top of what is called the "drier house." Here the material falls by gravity over screens of ½ in. mesh. All that will not pass through—the "spalls"—is recrushed and returned to the drier house. Material passing through the screens falls to the drier. This drier consists of a cast-iron box 40 ft. high, 8 ft. square and filled with baffle plates. The fall from the last screen to the bottom of the drier occupies just 25 seconds. The capacity is 3,000 tons per day. An 80-in. exhaust fan driven by a 60-hp. motor draws out the gases at the top of the stack and in the way of economy these are passed through the dust-settling chamber, thence to the atmosphere. By this drier process the percentage of moisture in the crushed rock is reduced to about one per cent from the original four or five per cent. The gases on emerging from the stack have a temperature scarcely above 212 deg. F.

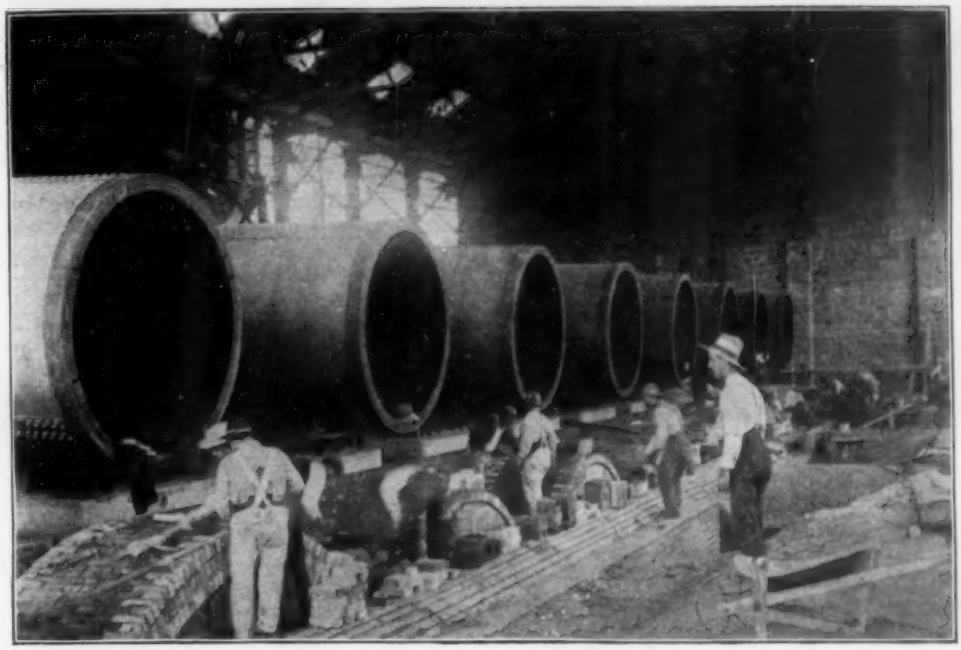
From the bottom of the drier stack the crushed stone is carried by a belt conveyer up an incline to the transfer tower and is delivered to another belt conveyer, and an automatic sampler draws samples as the rock passes from the one conveyer to the other. This sampler is a most ingenious piece of mechanism. It is a broad plate hinged something like a damper, and at stated intervals it is thrust forward into the material taking a 1-lb. sample at each thrust. It is withdrawn by means of a weight. It acts in accordance with the speed of the conveyor as it is only thrust forward in response to an escapement mechanism belted to the conveyor shaft.

On the second 24-in. conveyor the rock is carried down the full length of the stock-house cupola and by means of a self-propelled tripper deposits its load in bins, a number for each of the two materials, and an extra bin for mixing. Cement rock and limestone are mixed by discharging the contents of these bins upon belt conveyors running in a tunnel beneath. From the stock-house the tunnel conveyors bring the crushed rock to the first dump at the upper part of a weighing house where there are two 300-ton bins, one for cement rock and one for limestone, and a 10-ton weighing bin beneath each of these, in which the proper proportions of the materials are secured.

At what is known as the "chalk" grinding house, material is ground between sets of rolls to an exceeding fineness. These rolls have a compression of 1500 lbs. per square inch and handle about 300 bbls. of material per hour and about 86 per



**Ball Mills For Grinding Clinker**



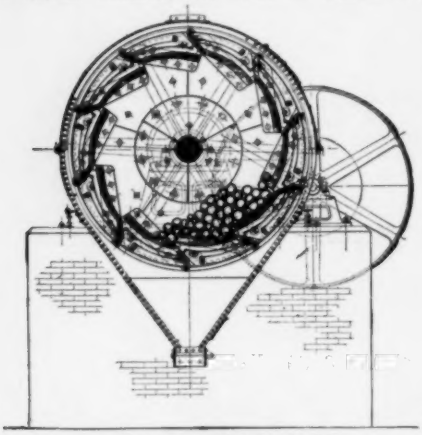
**Installing Rotary Kilns at the New Cement Plant at Hull, Canada**

cent of the ground material passes through a sieve having 200 meshes per linear inch. The ground material is conveyed to a blower house, where the finer is separated from the coarser. Entering at the top of the blower house, the belt conveyor passes two stationary trippers, each of which takes off its proportion of the load and replaces the rest. The material they take is supplied to the discharge pipes of sixteen fan blowers. The material, falling through a system of baffles and transversely through the current of air maintained by the blowers, the finely ground is carried into the settling room where it settles into bins but the coarse falls by gravity through the current of air, instead of being conveyed by it, and is sent back to the grinding house. From the settling room bins the chalk is conveyed to the chalk storehouse. The walls of the settling chamber are of coarse gunny sack, and much of the machinery throughout the plant is protected with this material.

From the chalk stockhouse, which is of 1,000 tons' capacity, the chalk is conveyed by a long screw conveyor to a belt which leads to the kiln house.

The burning of material in the huge rotary kiln is the most interesting process involved in the manufacture. The kilns used nowadays exceed in size anything that was seen four or five years ago. Time was when a steel kiln 6 ft. in diameter and 60 ft. long was considered a monster, but this large plant uses cast-iron kilns 150 ft. long and 9 ft. in diameter. These kilns, of which there are sixteen in the plant we are describing, are supported on 30 wheels, called "idlers," at 15 points of their length and revolve at a speed of about one revolution in 45 seconds. Power is supplied by geared motors midway of the kilns. The rotaries are inclined and are held in place by two thrust wheels bearing against turned rings encircling the shell. The output of each kiln is about 750 bbls. per day of 24 hours, and less than 75 lbs. of fuel is used per barrel of product. The fuel used is pulverized soft coal which must be especially prepared for the purpose. It is first put through what is called a "grizzly" in which the larger pieces are crushed, it then goes to a drier house where steam coils drive heated air through the drier stack at the rate of 30,500 cu. ft. per minute. From the drier the coal falls into a storage hopper and is taken by a screw conveyor to the coal grinding house. Here it passes through a tube mill and comes out in a finely pulverized state and is conveyed to a fine coal storehouse near the roaster. This fine coal is fed into the lower end of each kiln by means of compressed air.

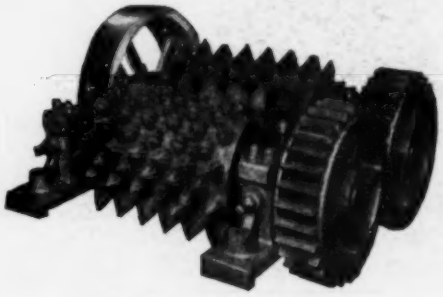
The chalk as it descends through the kiln reaches the stage of incipient vitrification and forms clinker, the heat to which it is



**Section of Ball Mill**

subjected being most intense. Sometimes it becomes wholly vitrified and collects in rings and obstructs the flow. A peculiar means is taken to again open the kiln. A naval gun operated by compressed air is loaded with a ready-made cement slug about 1½ in. diameter and 15 in. long and discharged into the kiln, breaking up the rings of glass within. At the lower end of the kiln the clinker drops out into a cylindrical revolving cooler. Air drawn through the cooler serves to cool the clinker, and as it passes over the hot clinker is heated, and this warm air is admitted to the kiln. The cooler rotates just as the kiln does; it is, however, set at a greater inclination and the clinker passes through more rapidly. From the cooler the clinker drops into a bucket conveyor from which it is spouted to what is called the "bad clinker" elevator and which discharges upon the pavement outside the roaster house. The clinker is then conveyed to the grinding house where it is first reduced in size by ball mills and then pulverized by tube mills. The proper amount of plaster of paris not exceeding two per cent is added after the crushing in the ball mill. This is to retard the setting of the cement. The ball mill grinds it by means of loose tumbling balls of steel carried in a rapidly revolving drum.

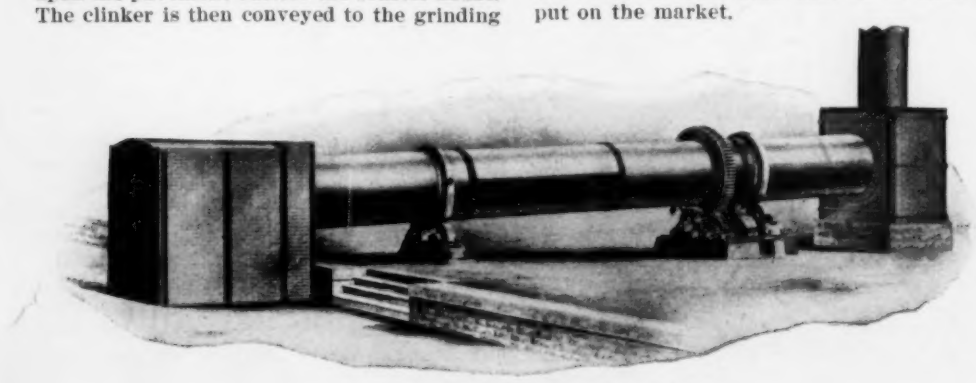
The tube mill reduces the clinker to the market fineness of which 92 per cent must pass through a 100-mesh sieve. The tube mill consists of a steel plate cylinder, provided with a driving gear and lined with hard iron, silex or porcelain bricks.



**For Crushing Coal**

Material is fed at one end through a hollow trunnion and discharged at the other end. The mill is filled to a point a little above its axis with material and pebbles and made to revolve, causing the mass of pebbles and material to tumble about, upon and over each other with wave-like undulations, producing an enormous grinding surface capable of reducing to any desired fineness without screening any dry material subjected to its action.

The pulverized cement is finally put through a second blower house which separates all coarse particles from the fine and is then stored until such time as it shall be put on the market.



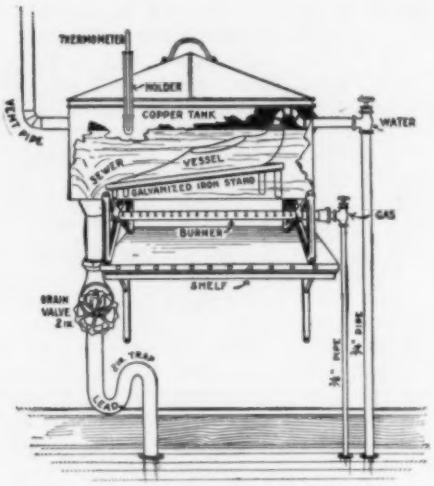
**Rotary Drier**

## DISINFECTING FILTER FOR HOSPITAL SEWAGE.

By Dr. Maurice Budwig

Sewage from hospitals, carrying with it germs of all manner of contagious and infectious diseases, is a menace to the public health and may at some far removed spot, contaminate whole communities. Germs of many diseases live through all extremes of weather, some of them for years, as in the case of the typhoid germ.

The only precaution against diseases being




**Filter for Hospital Sewage**

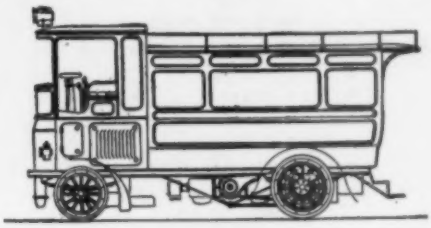
carried in this manner from hospitals is the thorough disinfection of sewage. My apparatus for this purpose consists of a copper tank into which the vessel containing sewage is placed and the tank filled with water. A powerful gas burner is arranged beneath the tank and brings the water to a temperature of 212 degrees F. The water is allowed to boil one minute and both vessel and contents are thus thoroughly disinfected.

A 2-in. valve at the outlet of the tank allows the contents to escape through a trap into the sewer, so that there is no chance of further infection. By turning the water valve the tank and vessel are cleansed.

An excellent quality of soft coal is found in the Indian Territory. The 116 mines produced 3,820,057 tons last year. The four coking plants coked 50,000 tons.

## ENGLISH STEAM OMNIBUS.

The latest steam omnibus has been built for the London Road Car Co. It is of 32 hp.



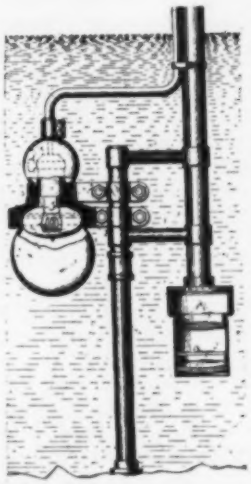
**London Steam 'Bus**

and kerosene is used for fuel. The vehicle seats 34 passengers and is of the double deck type.

Our readers are invited to contribute to the Shop Notes department any kinks which they have worked out, or may be using to advantage, and which others might use with benefit. We can make use of rough sketches of any size.

## NEW SUBMARINE TELESCOPE.

It is believed that in many cases a submarine telescope would avoid the necessity of a diver going down. Where a search is to be made, or where the diver must first locate an object before going to work upon it, the submarine telescope is calculated to save a great deal of time. It can be used at any depth to which a diver can safely descend. The viewing tube is made in sections which are added as the lower end of the tube, which contains the lens, is let down. In order to secure sufficient light at the bottom an electric lamp securely inclosed in a strong glass case is attached. When the light is turned on the water is illuminated and easily explored.



# Wonderful Discovery in Photography

## Portraits in Colors by a Purely Photographic Process--Negative Partly Developed Under Sunlight

Among all of the investigations and discoveries that have recently been made relative to the phenomena of light in connection with photography, the experiments of Mr. J. Ellsworth Hare, a Chicago photographer, are showing some of the most promising practical results. While photographers all over the world have been attempting to discover methods of photographing in colors or of producing colored photographs by one process or another, this young man has actually succeeded in producing portraits in colors by a purely photographic process. These portraits bear a distinctively poster character in appearance and, although the process has only been perfected within the past few weeks, the new style colored photographs are already commanding high prices among the members of Chicago's four hundred.

The process of making the "poster portraits in colors," as the inventor calls them, is a printing process, the result being brought about by a double exposure to the light and a triple manipulation of the chemicals. The photograph is made on a thin metallic plate, very light in weight, which is prepared by a complicated system of coating before it is ready for printing.

The first coat is of a collodion nature, containing the double salts of silver. After this coating has been allowed to dry over night in a dark room, it is recoated with a heavy coat of specially prepared and sensitized bicromate solution, in which enough black carbon pigment has been added to make the solution perfectly opaque. The plate, when thoroughly dry, is ready for printing.

An ordinary portrait negative such as is used by all photographers is used to print from. Although the operation of placing the sensitized metallic plate in contact with the negative must be done in the dark room, the printing is done in the sunlight. The first exposure is determined by time.

After the first exposure has been made the plate is removed to the dark room, where it undergoes a process of washing in hot water. This removes the opaque substance, or outer coating, from the high light part of the photograph, leaving the high lights and halftone portion of the underneath coating free to the action of light for the next exposure and the shadows remaining perfectly blank. The plate should then be thoroughly dried, when it is ready for the second exposure.

This exposure is made by artificial light, the time of which can only be determined by the printer's judgment. The plate is then ready for the toning bath, which is to produce the desired color. The different colors are produced by the use of a series of toning baths, the chemical combinations of which are a secret of the inventor. Thus a variety of shades from bright red to pink and from pale green to deep yellow are obtained in the high lights and throughout the half tones. This leaves a striking photograph in two colors, the high lights standing out from the black with marvelous effect, which makes the person photographed appear to be seated in a dark room with a flood of strongly colored light of the selected tint falling upon him.

Photographs of even greater effectiveness than those already mentioned are obtained in three colors by the same process, with the exception that colored carbon pigment is used in the bicromate solution in place of the black employed in the original process. This gives the shadow in one color, the high light in another and the half tones in a third color, which is produced by the presence of one color overlying another.

The metallic plate is used for two reasons. First, it acts as an opaque backing, which prevents the action of light on the inner or first coating from the back. Secondly and most important of all, the plate, having a hard surface, prevents the coatings from sinking in as is the case with photographs made on paper. This produces a photograph of a luminous quality. The latter effect constitutes one of the chief beauties of the new style of color photography and is a distinct innovation in the photographer's art.

The discoverer of the process explains his invention as an inspiration which came to him after dreaming over an idea and ruining scores of plates while experimenting during the past four years.

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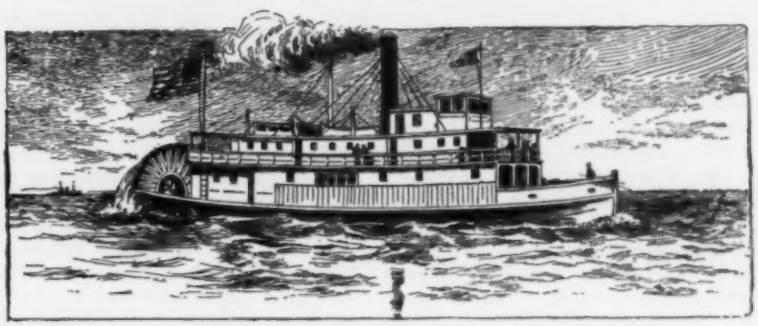
Little oak boxes are placed on some of the tombstones in Paris, and their purpose is for receiving the cards of those who visit the graves, that the friends of the deceased may know whom else holds the departed in loving remembrance.

# River Boat Made 1,000-Mile Ocean Voyage



**The "H. C. Grady" on The Tempestuous Pacific**

When the "H. C. Grady," a river steamboat formerly navigating the Columbia river, was sent down the Pacific coast to San Francisco bay last season, in response to a demand for flat-bottomed river steamers, seamen along the coast prophesied she would never make her destination in safety and the chances against it were so great that her crew deserted. The river boat in construction is not at all adapted to ocean navigation. The "H. C. Grady," a staunchly-built little craft 125 ft. long, 26 ft. beam and 26 in. draft, looked entirely out of place on the tempestuous Pacific. The guards of the craft were scarcely three feet out of the water, and the flat bottom somewhat less under water. The cabins and pilot house towered high in the air and offered a fine broadside to squalls. The stern wheel enhanced the difficulties, as when the bow dipped the stern flew up and increased the strain on the engines.

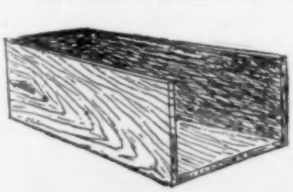
Nevertheless, with a crew of landlubbers under command of Captain Denny, the boat made the 1,000-mile ocean voyage in just five days without disaster.

## DAKOTA LIGNITE FOR IRRIGATING WORK.

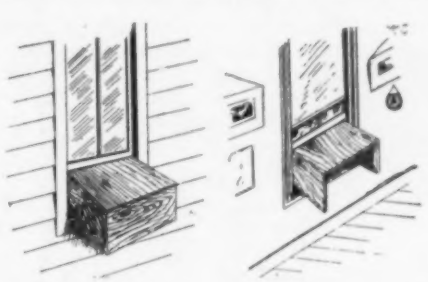
The production in great tracts of North Dakota land can be increased ten fold by means of irrigation. The U. S. Geological Survey, in a comprehensive report, recommends a plan for doing this. Great beds of lignite are near the surface, and crop out from hillsides. With suitable pumping machinery water from rivers and creeks can be raised 100 or more feet and easily distributed over the level plains. The lignite is very easily mined.

## HOW TO MAKE A STORM VENTILATOR.

The ventilation of a room in stormy weather in such manner that rain or snow cannot blow in and spoil curtains and carpets may be effected by a very simple means, says the Physical Culture Magazine.



Build a box with one end and one side open, using ½-in. boards (preferably matched), and making it just large enough to fit the sides of the window frame closely. The box may be of any depth desired, 18 in. is a good average. Paint, cover or stain the box to make it sightly and then adjust in the window as shown in the illustrations. The box need only be used in stormy weather, being removed entirely during fair weather. The current of air it admits to the room may be increased or decreased by allowing it to extend farther out on the outside, or by drawing it farther into the room.



**Exterior View** **Interior View**

# How Gas and Electric Meters Work

### One of Each Type Explained Will Make Others Easily Understood--Many Very Ingenious

Two types of gas meters are in use, the wet meter and the dry meter. Figs. 1 and 2 show the most important parts of a dry meter. In Fig. 1 is represented a cross-section of the tinned case having apartments C, D, E, and F. In apartments C and D are disks fastened together by flexible leather, L, forming a sort of bellows as in an accordeon. Piston and valves are represented at N. Suppose gas to enter at H, Fig. 2. Its pressure opens valves into Q which expands, driving the gas out of the chambers C and D into the consumer's pipe. As the bellows empty, the chambers refill. The amount Q will hold is known. Referring to Fig. 2, end view, N transmits the motion of the bellows to the shaft, S, which in turn moves the dial gear wheels, causing the hands to register the amount of gas passed in. B is a chamber containing levers and the dial mechanism.

Figs. 3 and 4 refer to a wet meter, Fig. 3 showing a front view and Fig. 4 the interior arrangement at the back. W represents the water level, water being put in at U. Too much water will overflow through V. A is a sheet metal cylinder. Within this revolves another cylinder on an axis. This cylinder is divided into four chambers, A, G, J, and K, having four outlets, 1, 2, 3, and 4. Gas enters around the axis and flows up through the tube T which reaches above the water line, W, into the chamber K. Its lightness causes the inner cylinder to revolve in the direction of the hands of a clock. The chamber K fills, revolves, then empties through 4, just as G is doing through 1. This rotation is transferred by the axis to a gear wheel, X, Fig. 3, and by the shaft, S, to the dial wheels, and is registered, the capacity of each chamber being known. This continues until the consumer's pressure is equal to that of the gas main, when the meter stops until the pressure again lessens in the consumer's pipe. Too high or too low water causes a float, G, to rise or fall, thus shutting off the gas until the meter is adjusted to read correctly.

Wet meters freeze and require more attention than dry meters and are less used. Dry meters should be frequently examined, as the leather will become hard and brittle with age.

To read the register, Fig. 5, of a gas meter, proceed as follows:

Dial "A" reads "6" because it has not yet reached "7." Dial "B" reads "7" for a like reason, and dial "C" reads "7." Put down

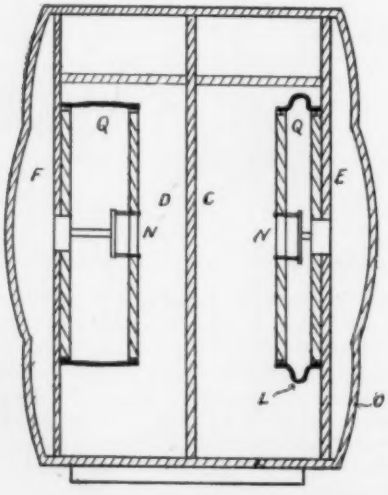
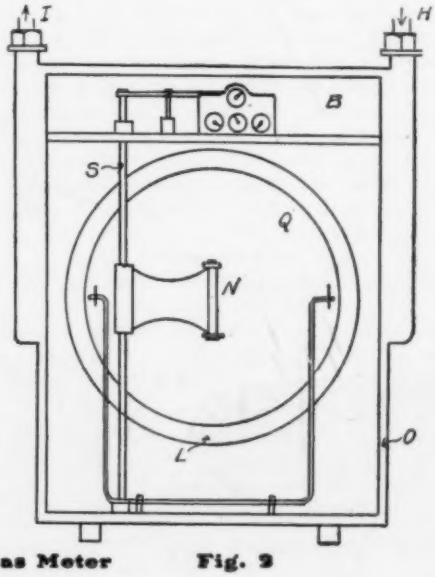



Fig. 1.




Dry Gas Meter Fig. 2

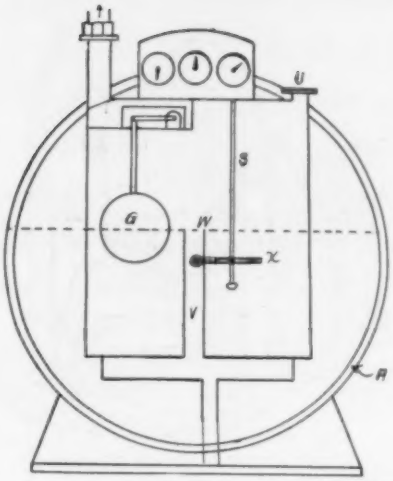



Fig. 3 Wet Gas Meter

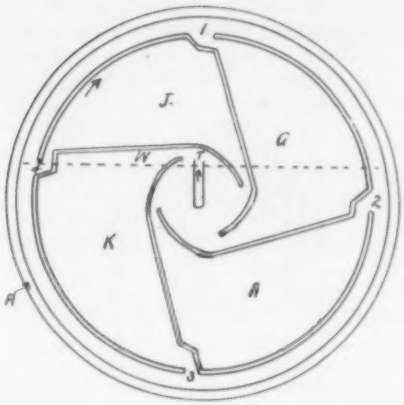



Fig. 4

these figures, namely, 677, and add two ciphers, because the lowest, "C," dial represents hundreds. Thus you have 67,700 cubic feet. Subtract from this the figures of the last month's reading, ending say 65,000, and you have what you must now pay for, 2,700 cubic feet.

An electric recording wattmeter is really

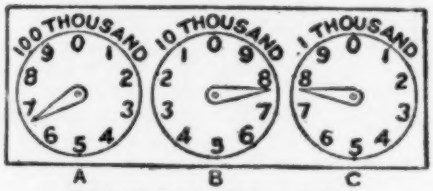



Fig. 5—Gas Meter Dials

an electric motor. To understand how it works, let us suppose a current of electricity to flow in a wire, Fig. 6, in the direction of the arrow. Experiment has shown that this wire will then be surrounded by a force which electricians call a field, or "lines of force," sometimes likened to rubber bands. This same strange force appears between the opposite poles of two magnets, as in Fig. 7, and in order to talk about it we will use the terms "field" or "lines of force." Suppose in Fig. 7 we are looking at the end of two wires, A and B, joined at the other end.

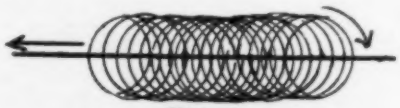


Fig. 6

The lines of force will run straight across from S to N if undisturbed. But send a current in at A and out through B and a field, rubber bands if you wish, forms, turning in the direction indicated by the respective arrows. These two fields tend to bend the lines of force running from S to N in the manner shown. At the same time, the S N lines try, like stretched rubber, to remain straight, lifting B up and pushing A down. Fasten these two wires to a center and we have the armature of a motor. In the wattmeter instead of one loop of wire, the armature is made up of a number of loops of fine wire which are wound lengthwise of a spool on the shaft. In place of the S and N poles of magnets, the wattmeter has two fixed loops or coils of heavy

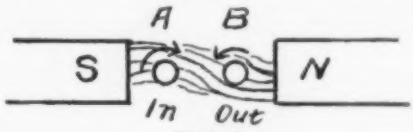



Fig. 7

wire, Fig. 8, and through these the current (amperes) to the consumer passes, making many, few, or no lines of force according as he uses much, little, or no current; and making the armature turn slow or fast as did A and B, Fig. 7. The armature is connected across the circuit coming into the consumer's house to get the effect of the electric pressure (volts). Combining the effect from the current coils, and that from the armature, the wattmeter reads amperes x volts = watts.

An additional loop of wire called a shunt, Fig. 8, is wound on the current coils to give enough added lines of force to make up for friction. Friction is slight, the shaft being set in jewelled bearings as in a watch. Sometimes too much current flows through the armature, even with no load. This makes the armature turn and is termed "creeping."

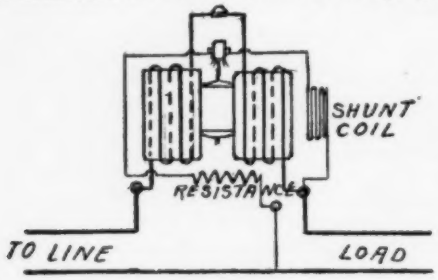



**Fig. 8**

It can be stopped by taking some of the wire out of the shunt coil.

As the shaft revolves a set of gear wheels are turned, registering on the dial the number of watt hours (watts x hours.) A wattmeter is tested by putting it on the same circuit with a reliable instrument, or on a known load. If it runs too fast the poles of the magnet, which act as a drag on a copper or aluminum disk, are brought farther from the axis, giving more leverage; if too slow they are moved toward the axis.

Wattmeters read either in watt-hours or kilowatt-hours. Referring to the register, Fig. 9, dial A has not registered; dial B reads "5" because it has not reached "6;" dial C reads "4;" dial D reads "2;" and dial E reads "7." Putting down these figures gives 5, 6, 4, 2, 7 watt-hours, or dividing by 1,000, gives 56.427 kilowatt-hours. Take from this the figures of the last reading paid for, say 46.427, and you now pay for 10.000 kilowatt-hours.

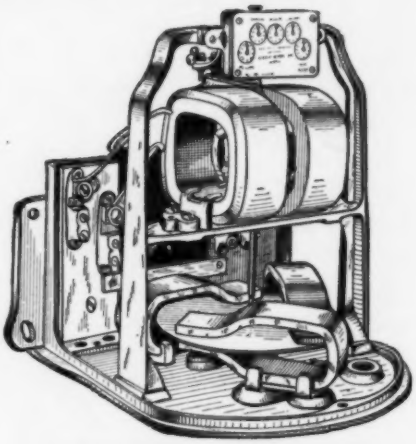


**Fig. 10. Watt Meter**

The hands on the adjoining dials revolve in opposite directions, hence a reading should always be verified, as it is easy to mistake the direction of rotation.

While excavating for the new Paris subway, the main postern and drawbridge of the Bastile was discovered. The gate is to be reconstructed on the Avenue Henri IV., where part of one of the towers of the famous prison fortress has been set up for a number of years.

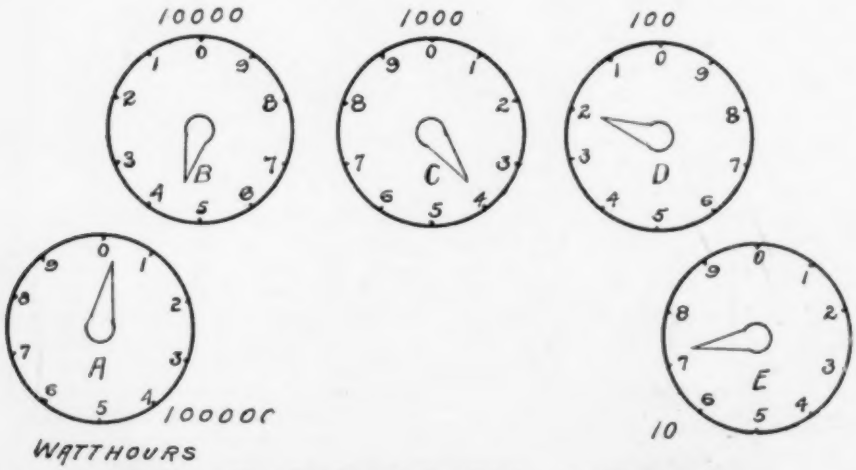



**Fig. 9. How to Read the Dials of a Wattmeter**

# SHOP NOTES

## USING MOTORCYCLES FOR SHOP POWER.

A motorcycle may be rigged up to run shop machinery with excellent results. The motorcycle will provide as much power as a 3-hp. gasoline engine and is not at all injured for use on the road by putting it to this purpose in the shop, says a correspondent of the American Blacksmith.

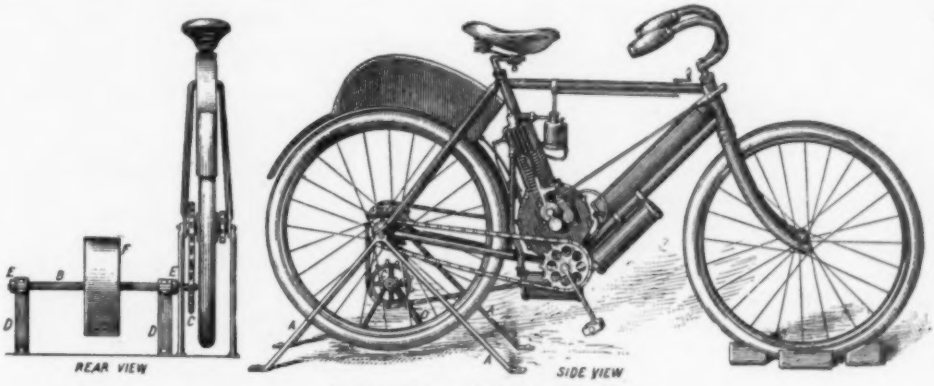
The arrangement is very simple. Make a stand, as shown in the sketch, to raise the wheel from the floor. Block the front wheel with a block on each side of the wheel, one in front and one at the rear. For the rear axle make a stand, A, and screw it fast to the floor. Make a small shaft, B, and fasten in the end of it a 20-tooth, ¼-in. sprocket, C. Have it flush. Make journals or bearings, D, to hold the shaft and use collars, E, to keep it in place. Set this directly under the large sprocket of the rear wheel of the motorcycle, fasten it there and get a chain long enough to reach all the way around. Make the pulley, F, 6x3 or 4x3, of whatever speed desired, and put in place. Set the machine upstairs or down, as desired, and run the belt from the spark shaft to the line shaft. Fill the bicycle tank, which holds 1 gal. of gasoline, sufficient for 100 miles' run at a cost of about 14 cents. It is not necessary to keep gasoline in storage as when riding to and from the shop one may have the tank filled at a store. The bicycle can be taken from its stand for use on the road in five minutes.

This arrangement is suitable for running a drill press, horse clipper, grindstone, lathe or emery wheel.

Dwelling houses of hollow concrete blocks have been constructed by the San Pedro, Los Angeles & Salt Lake R. R. for some of its section foremen. Each house is provided with a concrete cistern.

## REMOVING OLD GEAR WHEELS FROM SHAFTS.

Gear wheels which have been on the shaft a long while so that they are in a decaying condition may be removed by means of a ram rigged up as shown in the sketch.




Using a Motorcycle for Shop Power

Five-foot gear wheels with 9-in. hubs which had been on a 6-in. shaft for 12 years were removed in this way by C. J. Case of Troy, Pa. An old shaft, 4½ in. in diameter and 6 ft. long was hung from the ceiling by means of a rope. This served as the ram and was propelled by four men. The wheels came off readily.

Removing Old Gear Wheels

## COMPASSES FOR METAL WORK.

The compass shown at Fig. 1 can be made by most any one out of sheet material. The compass has no locking device, as it depends on the tightness of the point to keep it in

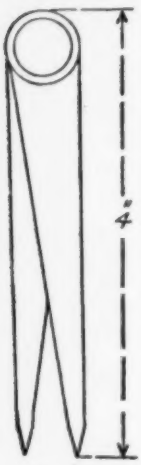



Fig. 1

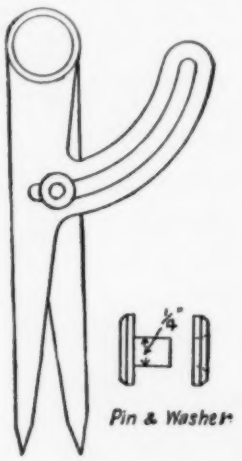


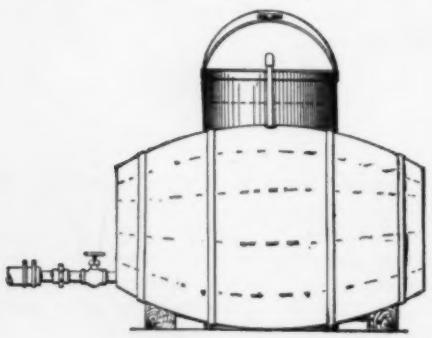

Fig. 2

position when in use. Use thicker material than is used for calipers, says the Model Engineer, London, and harden and temper the points. Fig. 2 shows another useful form of compass which is not difficult to make.

## AN EASY WAY TO EMPTY AN OIL BARREL.

For emptying oil from the barrel into the oil tank, the arrangement shown in the sketch is highly recommended by a correspondent of the Engineers' Review. The device is operated by air pressure.

A short piece of 2-in. pipe is fitted to a valve, and a nipple having the female side of a coupling screwed to it, is fitted into the valve. A rubber hose is connected with a piece having the male part of the coupling screwed on it and this pipe is connected to the air line. In the bung hole on the side of the barrel a pipe, proportioned so that it reaches up above the top of the tank and extends over so as to empty in through the round hole that is in the top of most tanks, is fitted.



Emptying an Oil Barrel

When ready to empty a barrel of oil, it is rolled near the tank, stood on end and a hole to receive the 2-in pipe having the valve is bored in it, the pipe is screwed in and the valve closed tight. The barrel is then tipped down, the plug in the side removed, and the pipe which runs up the side of the tank is screwed in. This should fit tightly so there will be no leaking. The air is then turned on, the pressure forces the oil up into the tank and the barrel is emptied in a short time.

It might be possible to work this scheme with water pressure, but unless there were some efficient means of draining the bottom of the tank, the little water that would be apt to collect there would cause the tank to rust.

## AGING OAK WITH AMMONIA FUMES.

Strong ammonia fumes may be used for aging oak says the Manual Training Magazine. Place the piece to be fumed, with an evaporating dish containing concentrated ammonia, in a box and close it airtight. Leave for 12 hours and finish with a wax polish, applying first a thin coat of paraffine oil and then rubbing with a pomade of prepared wax made as follows: Two ounces each of yellow and white beeswax heated over a slow fire in a clean vessel (agate ware is good) until melted. Add 4 oz. turpentine and stir till entirely cool. Keep the turpentine away from the fire. This will give the oak a lustrous brown color, and nicking will not expose a different surface, as the ammonia fumes penetrate to a considerable depth.

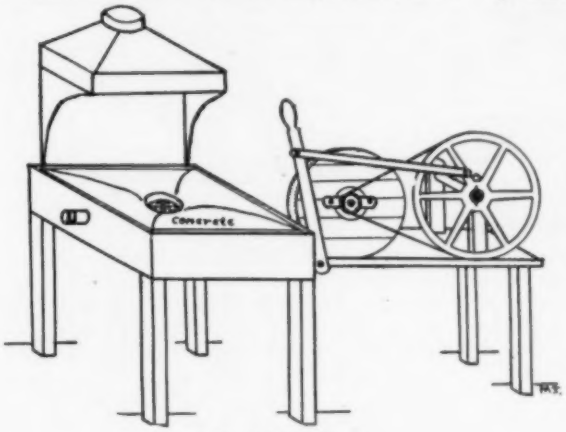
## PREPARING BORAX FOR USE IN WELDING STEEL.

Put 1 lb. of borax in an old iron kettle and set it over the forge fire and cook it thoroughly. Keep stirring slowly after the borax is all melted and until it resembles popcorn. There will be about three times the original quantity, and it will go farther and do its work better.—Contributed by Wm. Raymond, New Sharon, Iowa.

## HOW TO MAKE A SUBSTANTIAL FORGE.

The farmer or other person in a remote place who wishes to become his own blacksmith can make a cheap and substantial forge in one day, after the following method:

Make a square box of 8-in. board, 2 ft.




A Home-Made Forge

on the sides, and place legs of convenient length inside the corners. Nail a solid floor on the bottom of the box. In a 2-in. iron pipe, 30 in. long, drill about a dozen ¼-in. holes in a small circle near the center. Pass the pipe through snug holes cut in two opposite sides of the box, leaving it protrude 2 in. on either side. If one end of the pipe is threaded, screw it into fan before running through the box.

Make concrete of Portland cement, one part, sand three parts, and mix with enough water to make it of the right consistency. Tamp the concrete into the box above and below the pipe, leaving the top sloping toward the holes in the pipe. Put a heavy 4-in. ring around the holes and cement it in. A plug in the outer end of the pipe allows ashes to be blown out when necessary.

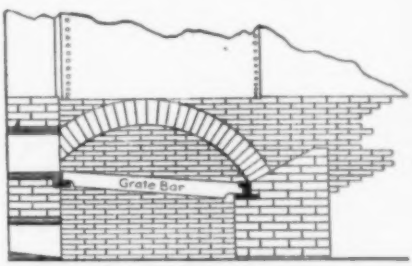
The fan should be about 6 in. wide and 18 in. in diameter, with iron or hard maple boxes and a 2-in. pulley. Mount the fan on the same board that forms the bottom of the forge box, for rigidity. A hood may be suspended over the hearth and connected to the forge back by a strip of sheet iron. When the cement has hardened, a durable fireproof forge is the result. A welding heat can be obtained in one minute with this outfit.—Contributed by Muron Tombaugh, Streator, Ill.

## A GERMAN METHOD OF CLEANING MACHINERY.

The use of blotting paper for cleaning machinery in many of the large shops in Germany has been found very effective and economical. The German workman formerly used on an average 250 grams of cotton waste, one new sponging cloth and one or two renovated ones per week; now he is supplied with 150 grams of cotton waste and eight to ten sheets of blotting paper, at a cost of two and a half cents, instead of six and a quarter cents, as formerly. The paper is, therefore, not only cheaper, but does not soil the engine with fiber and dust, like sponge cloth and woolen waste, which was used, besides being otherwise preferable even to cotton waste. It has the advantage of being less combustible than other cleaning materials, and safer in another way; by eliminating the chances of having the hand drawn into moving machinery while in process of cleaning.

## ARCH IN SIDE WALLS OF FURNACE.

The constant repairing of side walls of the furnace of externally fired boilers is a big item of expense. An arch in the side wall, spanning the entire length of the grates, will save the cost of its installation many times in a year, says a correspondent

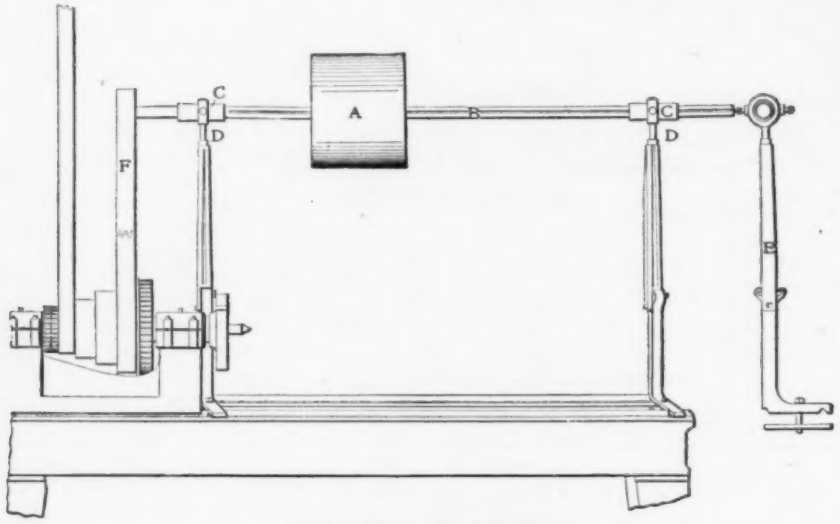



Arch in Side Walls of Furnace

of the National Engineer. When the fire brick are burnt out and must be replaced, only the brick beneath the arch need be removed, and the upper part need not be interfered with. Each engineer must determine the height of the arch required in his individual case.

## GRINDING ATTACHMENT FOR A LATHE.

A grinding attachment, intended for short work and internal grinding, which does away with an overhead drum with belt and hangers and which can be put on and taken off a lathe in a few moments is described by a correspondent of the American Machinist.




Grinding Attachment for a Lathe

The shaft, B, has a spline, so that the drum, A, which is provided with set screws to fasten it, can be slid to any position over the lathe bed. The shaft boxes, C, are self-adjusting and can be raised to take up the slack of the belt, F, and then secured by the collars, D. The upper portion of the stanchion, E, is hinged so that the shaft and drum may be swung to conform to the different angles in which the grinder is used, and thereby causes a flat belt to run better on the driving pulley of the grinder. Silk ribbon is used for high-speed belts. Any simple form of grinder can be fastened to the tool block of the lathe and belted to the drum, A. The stanchions are fitted to the slides of the lathe and held by a bolt that screws into a flat piece placed under the inside projections of the lathe bed.

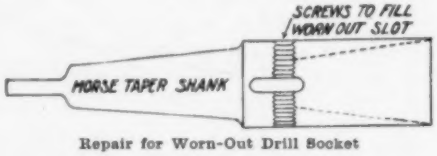
The belt, F, must be connected so it can be readily put together or taken apart. A steel belt hook fastened to one end of the belt may be used successfully with holes punched in the other end, so that the hooks when slightly bent will enter and stay as well as when clinched.

## HOW TO MAKE TRACING PAPER.

Tracing paper for use with either pen or ink may be made by brushing a solution, consisting of one part of castor oil in two parts of methylated spirits (poisonous), over one side of some good thin printing paper. Blot off and hang up to dry, after which it is ready for use.

## REPAIRING A WORN-OUT DRILL SOCKET.

There is an old and easy method of repairing a worn-out drill socket which may not be known to some, and which will be found of particular benefit in repairing morse taper shanks, which in time become




Repair for Worn-Out Drill Socket

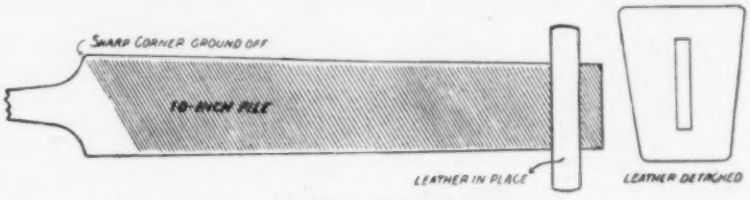
worn so that the tang will no longer hold. By drilling out and tapping at the bottom of the slot a piece may be screwed in and squared out again, thus making the socket as good as new. By drilling from each side and tapping, a plug may be made a very tight fit, thus avoiding any chance of working loose.—Contributed by A. C. Eggleston.

The 1905 edition of Shop Notes just out; 200 pages; 385 illustrations; only 50 cents.

## SUBSTITUTE FOR A SWAGE-SHAPER.

A filer who had some full-swage gang edger saws to fit, but had no swage-shaper, used a side file instead and put the same bevel on each tooth in a manner which was both ingenious and efficient.

In a small piece of leather belting, nearly ¼ in. thick, he cut a slot so that it could be slipped over the end of a 10-in. file. He held the file on an emery wheel and ground off the sharp corners so they would not scratch the saw. Then by resting the leather on the saw plate, it gave him a bevel back from the face of the tooth and also from the extreme cutting edge towards the eye of the saw. This gave a tooth with the cutting edge the widest. By the aid of a gage he filed until the swage just touched the gage and so made all teeth the same spread. The saws so made worked nicely and cut smoothly, says a correspondent of the Wood-Worker, but the method is recommended only for emergencies when a swage-shaper cannot be had.



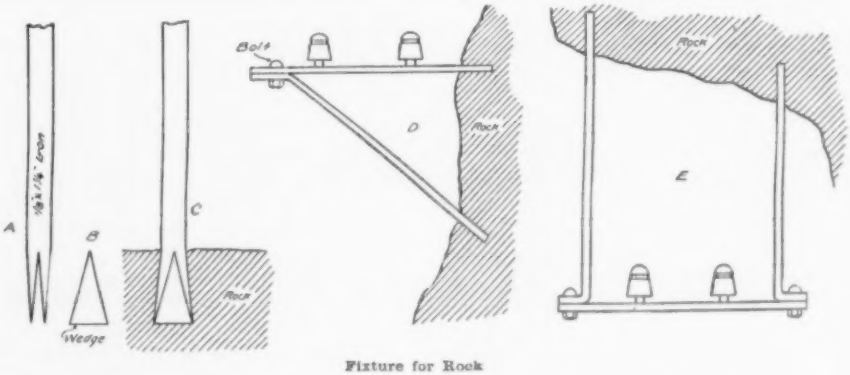

Swage-Shaper Substitute

In a new clock for a sick room, an electric lamp is arranged behind the dial, and when the invalid presses a button, the shadow of the hours and hands, greatly magnified, is thrown on the ceiling where he can see it without turning his head.

## A GOOD METHOD FOR ATTACHING LINE WIRES TO ROCK.

Telephone lines must often pass in a circuitous and lengthy route in mountainous countries, because of no convenient means of attaching wires to rock. A correspondent of the American Telephone Journal describes a good rock fixture for this purpose.

A piece of strap iron, ⅛ in. by 1¼ in. and tapered slightly at one end is split in the center of the tapered end as shown at A in the drawing. A hole 4 in. deep is then drilled in the rock, and a wedge, like B in the sketch (previously made), is placed in the split end of the iron rod and the rod is then driven into the hole drilled in the rock, as at C. It is practically impossible to withdraw a rod put in in this way as the two fingers of the rod spread apart as it is driven against the wedge, and the effect of an expansion bolt is produced.




Fixture for Rock

The sketch shows this scheme applied to a vertical rock at D, the two rods or straps being bolted together, and applied to the under side of a rocky ledge at E. In each case, the insulators are screwed to steel pins, which are screwed to the iron straps.

A hot pin may be cooled by pouring a half teaspoonful of aqua ammonia in the oil cup with the oil.

## HOW TO MAKE A FOUR-EYE MAST BAND.

On all ship yards and masts and on derricks, also, bands having a number of eyes are used, the number being determined by the circumference of the mast. The purpose of the band is to strengthen the mast

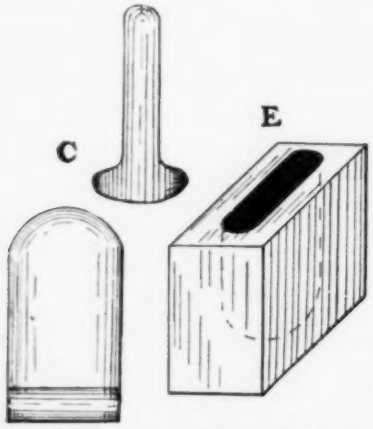



Fig. 1—Jump and Stamp Block

and to equalize the strain on it when lifting weights. On one eye (on a boat the eye pointing toward the bow) is hung the boom or spar for lifting the weights, and to each of the others is fastened a wire stay so that each pulls against the other and causes a down pressure instead of a side pressure, says the American Blacksmith.

To make such a band having four eyes, first determine what the circumference of the band should be. Suppose the mast is 16 in. diameter and the iron for the band 4 in. wide and 1½ in. thick. To the 16 in. (diameter) add 1½ in. (thickness of iron) which gives 17½. Multiplying this by 3 1-7 gives 55 in. as the required circumference. This divided by the number of eyes to be used (4) gives 13¾ in. as the distance from center to center of jumps.

Mark the center in a bar of iron 60 in. long, as at H, Fig. 2, and measure half the distance there is to be between jumps, or 6⅞ in., at one side of the center, and upset well as at A, Fig. 2. Drive the fuller down into this upset portion well, and by splitting with a hot chisel and fullering with a sharp fuller, gradually shape as shown at B. Measure for each jump from the first one made and make the other three in the same way.

Have ready the four jumps as shown at C, Fig. 1. Heat one of the jumps and a portion of the bar into which it is to go to a good red heat, set the bar on its edge and drive the jump into place. Hammer and scarf down well as at D, Fig. 2. Place in the fire, put a thin shell over it, and slowly heat, being careful not to burn it. When it is hot, put it in the stamp block, E, Fig. 1, and drive down well. Knock the stamp block off, finish the edges and chamfer between Y and Z. Put a jump on at P, Z and X.

The band should be first bent at each jump, as at F, so the jump will not tear it when bending to a circle. Measure off the circumference as at G and I, Fig. 2, add the thickness of the iron for welding and bend and weld. To work the eyes in the

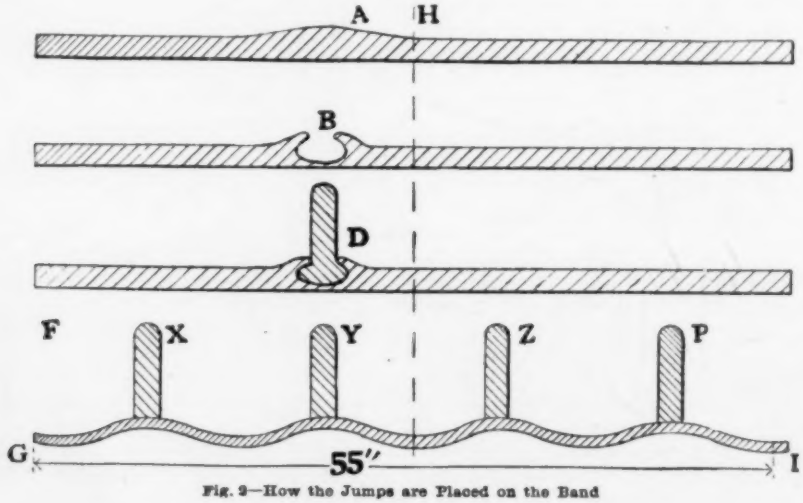
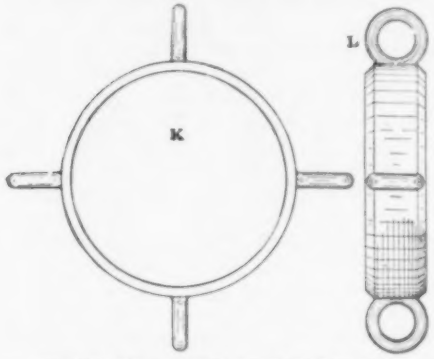



Fig. 2—How the Jumps are Placed on the Band

jumps, use a round punch, flattened at the point, which will swell out in the iron when punching. Round the eyes with an eye-bolt fuller and swage. The finished band is shown at K and L, Fig. 3.




Top and Side Views of Finished Mast Band

This makes a neat solid job, with jumps that will not tear out or loosen either while bending the band or punching the eyes in them.

## HOW TO LETTER ON TIN.

Draw the letters and ornaments upon a smooth, thin piece of light brown paper, one-half inch larger than the sign, using a lead pencil and making the characters neatly and precisely. Rub whiting over the back of the paper, a neat coating, and place the whiting side directly upon the face of the tin. Remove both to a drawing table and tack firmly in place through the margin of paper. Go over all the letters, etc., with a tracer, or other sharp point; this will leave a white line on the tin, so transferring the pattern, and it is then ready for laying gold size, or for finishing in any other way desired. When all is through, says the Master Painter, rub off accidental spots of tracing with a pad of cotton.

## HOW TO REMOVE FILM FROM A SPOILED NEGATIVE.

Hold the plate over a pan of boiling water for a few seconds, being very careful not to melt the film, until the film slips by the pressure of the thumb. It if fails to come easily, hold again over the steam. This is the simplest method, says the Photo-Beacon.

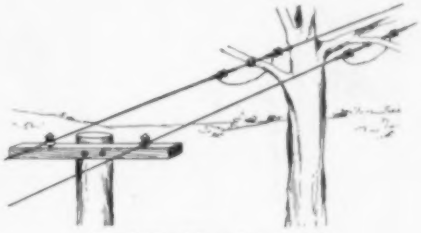
## INSULATING WIRES FROM TREES.

The following method of insulating wires from trees comes highly recommended from one who has had considerable experience in line work.

To each end of a piece of No. 6 gauge, hard-drawn wire, 3 or 4 ft. long fasten a glass insulator, first knocking the end of the insulator out with a piece of iron so that there is a hole clear through. For a 1,000-volt-current use but one insulator on each end of this wire, but where for 2,000 volts use insulators on each end. Twist the wires on the insulators securely.

Fasten this wire to the limb or any part of the tree affected by the line wire by means of a loop of greasy leather nailed to the limb and large enough for the wire to pass through freely.

Put the line wire through the groove of the insulator on one end of the still wire, loop it loosely across under the limb so



Insulating Wires from Trees

that it touches no part of the tree, and fasten it at the other side to the insulator on the other end of the still wire.

This affords excellent insulation in wet weather and is just as safe then as any other part of a good line.—Contributed by W. J. Catlin, Glen Ellyn, Ill.

## A GOOD BROWN FOR VEHICLES.

A good brown color for vehicles is obtained by using Indian red and black for the first coat, and black rubbing varnish charged with vermilion for the second. Burnt umber and burnt sienna in proportions to taste will give a warmer brown. Add a little white if too dark, or burnt and raw umber in equal parts. Make the first coat flat, and the second color-and-varnish. —From John L. Whiting & Son's book, "What Else to Do."

**Popular Mechanics mailed monthly, postage prepaid, to any address in the world, $1 per year**

## ABUSE OF TWIST DRILLS.

Before proceeding with this article I wish to state that I look at all things from a proprietor's point of view. Therefore, I want to tell just how our drill case appeared to me. I believe I am safe in saying that twist drills receive more abuse than any tool about the shop, and when a man is compelled to buy them he is interested in the care they receive. They are run at all speeds, and in case of a hurry-up job, I have seen the fire fly. The pressure applied to them varies according to the strength in the operator's arms, which covers a wide range, from 50 lbs. up to and including a ton, or whatever he is capable

Fig. 1.

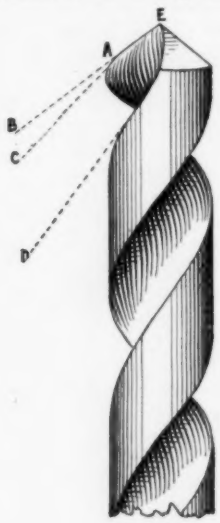



Fig. 2.

of pulling on a lever and twisting on a hand wheel.

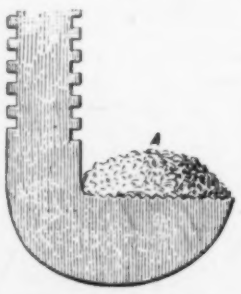
Judging from the looks of our drill case, they have been used as punches, but they did not give as good service as the boiler punches did. The point of the drill looked like Fig. 1. Worn off to about one-half size, the cause being too high speed. If one of the boys becomes a little excited, he immediately declares war against the small tools. The twist drill, of course, bears the brunt of the attack. The weapon used is an emery wheel, which is very destructive to the drill when the boys get excited. As I viewed our drill case I thought of the old story of John and the pants which he brought home on Saturday evening to wear the following Sunday morning. Finding them 2 in. too long, he instructed his mother to cut off 2 in. Fearing she would forget, he instructed his sister, also fearing that she, too, might forget, he instructed his grandmother likewise. It so happened that the mother, sister and grandmother had good memories. And they each cut off 2 in. John's pants reached the high water mark the following Sunday morning. So it is with the twist drill. Frank uses a drill and wears the outer points of the cutting edge off in a rounding shape (A, Fig. 2); Bill grinds the rounding points off without grinding the point (E, Fig. 2); making the angle that of B; Bill also wears the outer points off; Frank again grinds after Bill without grinding the point, E, making the angle that of C. This is repeated, each grinding after the other the dull outer edge without grinding the point, until the angle, D, is reached. At this stage the honor of being a first-class countersink is bestowed upon the drill. The angle, like John's pants, has reached high water mark.—Paul S. Baker, Muscatine, Iowa.

## WINE COLOR FOR VEHICLES.

A good "wine color" paint for vehicles is made by adding a little vermilion to carriage part lake. Use a standard grade, and one coat of this and a coat of color-and-varnish will cover without any ground.—John L. Whiting & Sons' Book, "What Else to Do."

## HOW TO HARDEN A STILLSON WRENCH.

The easiest method of hardening a Stillson wrench is to take the jaws out, anneal them and file them sharp. Then heat the




jaws red and lay some nitrate of potash on the jaws and teeth as at A in the sketch and plunge into water. A correspondent of the Blacksmith and Wheelwright says he has had jaws tempered in this way for years, and has never experienced difficulty in getting the right temper.

## TO PROTECT A MOTOR FROM DUST.

To protect a motor from dust, which is sure to be present even where a fan system is used for carrying it away, a galvanized iron cover, A, Fig. 1, made to fit the

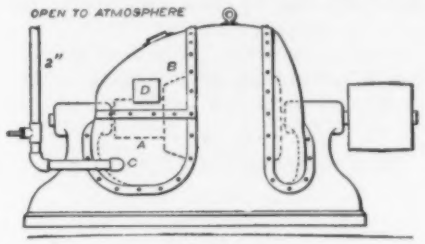



Fig. 1

motor frame snugly and fastened rigidly to the frame, is satisfactory, says a correspondent of the Engineer. Access to the commutator and brushes is afforded by a hinged cover, B, and sparking may be detected, without opening the casing, through a peek-hole, D, about 4 in. square and covered with mica.

A jet of air, supplied by the siphon or jet blower shown in Fig. 2, and which is operated by compressed air, is kept blow-

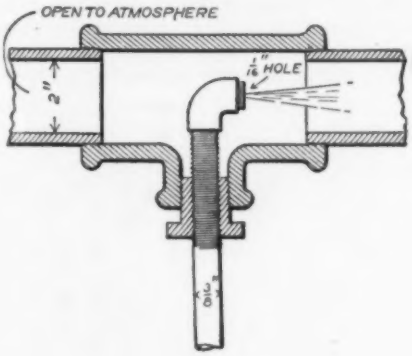



Fig. 2

ing in at C, and the air forces its way out through the openings and cracks at the top and sides of the machine. This jet of air allows no dust or grit to settle upon the motor and keeps the machine cool, also.

The color of common mahogany may be improved by applying a solution of potassium hydrate, or lye, to the surface. To determine the required strength of the solution test on a piece of waste stock of the same kind before applying. Fill with a dark paste wood-filler, varnish and polish with shellac.

## READY REFERENCE METRIC CONVERSION TABLE.

C. H. Nicolet, of La Salle, Ill., sends to Engineering News the table which we print below, and regarding which he says:

I send herewith an excellent little conversion table which has had a place in my pocket note-book for many years, and has proven very useful. It is sent to you with the belief that it may be appreciated by other engineers. The arrangement of the

| | | | | |
|---|---|---|---|---|
| Millimeters | × | .03937 | = | Inches. |
| " | = | 25.400 | × | " |
| Meters | × | 3.2809 | = | Feet. |
| " | = | .3048 | × | " |
| Kilometers | × | .621377 | = | Miles. |
| " | = | 1.6093 | × | " |
| Square centimeters | × | .15500 | = | Square inches. |
| " " | = | 6.4515 | × | " " |
| Square meters | × | 10.76410 | = | Square feet. |
| " " | = | .09290 | × | " " |
| Square kilometers | × | 247.1098 | = | Acres. |
| " " | = | .00405 | × | " " |
| Hectares | × | 2.471 | = | " " |
| " | = | .4047 | × | " " |
| Cubic centimeters | × | .0611025 | = | Cubic inches. |
| " " | = | 16.3866 | × | " " |
| Cubic meters | × | 35.3156 | = | Cubic feet. |
| " " | = | .02832 | × | " " |
| " " | × | 1.308 | = | Cubic yards. |
| " " | = | .765 | × | " " |
| Liters | × | 61.023 | = | Cubic inches. |
| " | = | .01639 | × | " " |
| " | × | .26418 | = | U. S. gallons. |
| " | = | 3.7854 | × | " " |
| Grams | × | 15.4324 | = | Grains. |
| " | = | .0648 | × | " |
| " | × | .03527 | = | Ounces, av'dupoise |
| " | = | 28.3495 | × | " " |
| Kilograms | × | 2.2046 | = | Pounds. |
| " | = | .4536 | × | " |
| Kilog's per sq. centimeter | × | 14.2231 | = | Lbs. per sq. inch |
| " " | × | .0703 | × | " " |
| Kilogram per cubic meter | × | .06243 | = | Lbs. per cubic foot |
| " " | = | 16.01890 | × | " " |
| Metric tons (1,000 kilog's) | × | 1.1023 | = | Tons (2,000 lbs.) |
| " " | = | .9072 | × | " " |
| Kilowatts | × | 1.3405 | = | Horse-powers. |
| " | = | .746 | × | " |
| Calories | × | 3.9683 | = | B. T. units. |
| " | = | .2520 | × | " |
| Francs | × | .193 | = | Dollars. |
| " | = | 5.18 | × | " |

table is especially commendable, as the entire conversion process is at once apparent, thus:

M = (millimeters) × .03937 = I (inches) or, reversing,

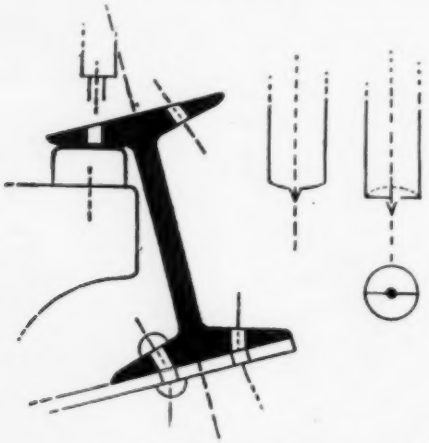
I (inches) × 25.4 = M (millimeters).

## TO PROTECT LABELS ON BOTTLES.

To protect labels on bottles so that they will adhere for years and not be affected by acids or dampness first give them a coating of size, and then a coating of gelatine, prepared by swelling a little cooking gelatine in cold water and making it fluid by placing the vessel containing it in a dish of nearly boiling water. Allow the gelatine coating to dry and then apply a single coat of "church" or "oak" varnish which will dry in a few hours, and affords better protection to the labels than other quick-drying varnishes. The Photo-Beacon says that the labels on bottles in chemical laboratories are protected in this way.

## PUNCHING STRUCTURAL STEEL FOR LOCOMOTIVE TENDERS.

Structural steel shapes, chiefly channels and I-beams, are used in the construction of locomotive tenders, and many methods are used in the various shops for punching these rolled shapes, says Railway and Locomotive Engineering. Most of these



Punching I-Beams

methods are very difficult of execution as an attempt is made to do the punching so that the axes of the holes shall be parallel with the web of the rolled sections.

In one railway shop a much simpler method of punching without reference to the parallel idea, so far as the axes of the holes is concerned, is used. The bevel side of the flange is laid flat on the die and the descending punch encounters the upper surface of the flange at an angle. This method of punching causes the holes to be as they appear in the illustration. A reamer, when run through before rivets are applied, somewhat modifies the angle at which the hole is punched, but the rivets when driven are not straight; the important point, however, is that the holes of the I-beam and the plate are absolutely in register, and as the rivet is made to fill both holes, and as there is no vestige of a shoulder at the point of union, the bending of the axis of the rivet is not thought important. In fact, a certain advantage is claimed for it, and that is that the bent rivet lessens the strain on the rivet heads, and the punching can be done without any specially constructed supports or apparatus for holding the steel I-beam or channel in place. A shearing punch is not necessary, but the face of the punch should be flat or slightly hollow, and not rounded.

## TO MAKE CASEIN COLD WATER PAINT.

Either of the following formulae for making casein cold water paint is recommended by the Master Painter:

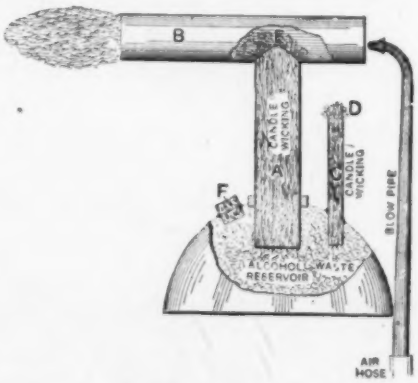
For interior use—10 lb. pure casein, 1½ lb. soda ash, 58 per cent; 88½ lb. plaster of paris or whiting.

For exterior use—9 lb. pure casein, 4 lb. pulverized air-slaked line, ¾ lb. silica, 86¼ lb. plaster paris or whiting.

## HOW TO MAKE AN ALCOHOL BURNER.

An alcohol burner which is much safer than a gasoline torch for soldering and other purposes may be made at home. The one shown here was devised by a correspondent of Machinery, who says, that while the flame cannot be focused to a small point, the burner is very handy for drawing the temper in broken taps.

To make the burner take the bottom of an oil can, stuff it full of waste, and solder in the brass tubes, A and C. Draw candle-wicking through these tubes, as shown. At the top end of tube, A, fit another tube, B, and drive A into an opening at E. Have a hole at F, plugged with a cork, for refilling. Solder a blowpipe into permanent position, the small end being nearly central to the open end to tube, B, serves also as a handle to hold the burner.




Home-Made Alcohol Burner

To start this torch, light the wicking in tube C, which will heat tube B. The alcohol gathered at E will form a gas immediately; the gas ignites and comes out of both ends of B, when the air is forced into and through the blowpipe the flame will come

from the opposite end of the blowpipe. The flame is very green in color and somewhat better than the flame from a gasoline torch.

## THREADING AN ELL.

In removing an old hot water tank having 1½-in. connections and replacing it with a larger tank having 2-in. connections, a correspondent of the Metal Worker, who had no fittings of any kind larger than 1½-in. on hand, but had a 2-in. die and stock and vise made good connection by threading an

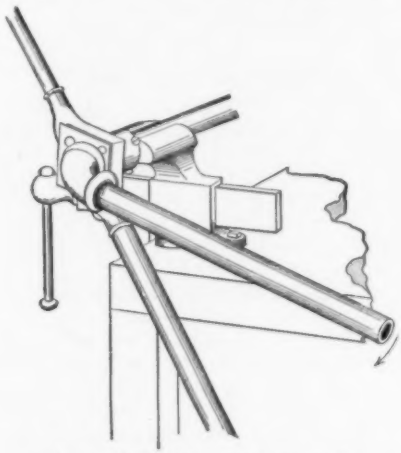


Fig. 1. Method of Threading An Ell

ell. To apply this kink under similar conditions, proceed as follows:

Start a 1½-in. beaded malleable iron ell on one end of a piece of pipe about two or three threads. Take the faceplate out of the stock and put in the 2-in. die, reversed from the ordinary position. Slip the pipe through the dies and guide until the ell strikes the die. Then grip the pipe tightly in the vise, close to the guide; put a piece of pipe over the handle of the stock, so as to reach to the floor and prevent the stock from turning. Into the other end of the beaded ell screw a piece of 1½-in. pipe 2 or 3 ft. long. Then everything is ready to start the work and in a very few minutes a 2 x 1½ in. street ell can be produced, as the operation will thread the bead on the outside of the ell.

Fig. 1 shows the method of working. The screwing up of the ell on the threaded pipe feeds or forces it into the 2-in. die and results in a thread being cut on the outside of the bear, so that it can be screwed into any 2-in. fitting. Another advantage that this manufactured ell has when it is completed is that it is threaded on the inside so as to receive the delivery tube or pipe, as shown in Fig. 2, to conduct the cold water to the bottom of the boiler.

The table below shows what sizes of pipe

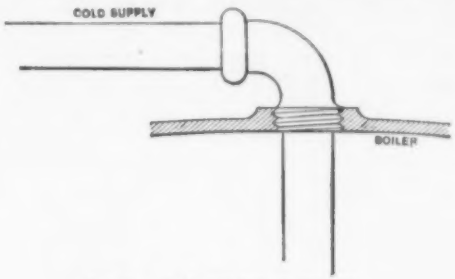


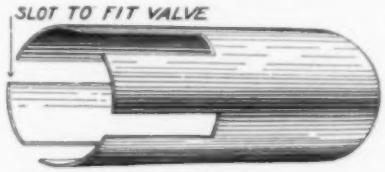

Fig. 2. Ell Threaded on Outside

for different fittings now on the market can be threaded:

1½-inch beaded fitting can be threaded to fit 2-inch pipe.
1¼-inch not adapted for any standard size.
1-inch plain fitting can be threaded to fit 1¼-inch pipe.
¾-inch plain fitting can be threaded to fit 1-inch pipe.
½-inch plain fitting can be threaded to fit ¾-inch pipe.
⅜-inch plain fitting can be threaded to fit ½-inch pipe.
¼-inch plain fitting can be threaded to fit ⅜-inch pipe.

## WRENCH FOR REMOVING VALVES FROM PUMPS.

Any size pipe can be used as a wrench for this purpose by taking a hack saw and sawing slots in it to fit the bridging on the pump valve. Such a wrench is easily made




Novel Wrench

with but few tools. Valves that have been in pumps for years I have removed in this way with a 3-in. pipe.—Contributed by W. J. Catlin, Superintendent Electric Light and Water Works, Glen Ellyn, Ill.

For lubricating journals, a compound consisting of one part fine plumbago and eight parts Albany grease is good.

All the articles appearing in this department are reprinted in book form at the end of the year. Price 50 cents postpaid.

## TABLE OF KILOWATT-HOUR COSTS.

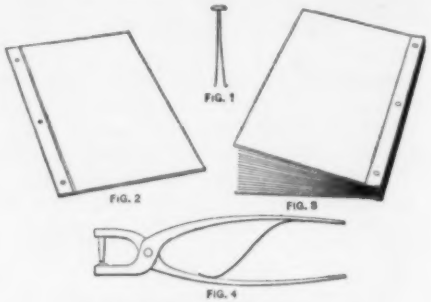
It is frequently necessary to reduce kilowatt costs per year to kilowatt-hour costs, or vice versa, and to do so entails calculations that though simple are irksome, says a correspondent in Journal of Electricity, Power and Gas. Such costs, of course, depend upon the hours of daily service rendered, and in ascertaining them it has been found convenient to reduce them to a tabulated form for ready reference, when they appear as follows for daily services amounting to ten, twenty-one and twenty-four hours respectively:

| Cost Per Kilowatt-Hour | Cost Per Kilowatt-Year—Hours Per Day. | | |
|---|---|---|---|
| | 10 | 21 | 24 |
| $0.015 | $54.75 | $114.97 | $131.40 |
| 0.0145 | 52.92 | 111.14 | 127.02 |
| 0.014 | 51.10 | 107.31 | 122.64 |
| 0.0135 | 49.28 | 103.48 | 118.26 |
| 0.013 | 47.45 | 99.64 | 113.88 |
| 0.0125 | 45.62 | 95.81 | 109.05 |
| 0.012 | 43.80 | 91.98 | 105.12 |
| 0.0115 | 41.98 | 84.15 | 100.74 |
| 0.011 | 40.15 | 81.13 | 96.36 |
| 0.0105 | 38.33 | 80.48 | 91.78 |
| 0.010 | 36.50 | 76.65 | 87.40 |
| 0.0095 | 34.68 | 72.82 | 83.22 |
| 0.009 | 32.85 | 68.98 | 78.84 |
| 0.0085 | 31.02 | 65.15 | 74.46 |
| 0.008 | 28.20 | 61.32 | 70.08 |
| 0.0075 | 27.37 | 57.49 | 65.70 |
| 0.007 | 25.55 | 53.65 | 61.32 |
| 0.0065 | 23.72 | 49.82 | 56.49 |
| 0.006 | 21.90 | 45.99 | 52.94 |
| 0.0055 | 20.07 | 42.16 | 48.18 |
| 0.005 | 18.25 | 38.32 | 43.80 |
| 0.0045 | 16.42 | 34.47 | 39.42 |
| 0.004 | 14.60 | 30.66 | 35.04 |
| 0.0035 | 12.77 | 26.83 | 30.66 |
| 0.003 | 10.95 | 22.99 | 26.28 |
| 0.0025 | 9.12 | 19.16 | 21.90 |
| 0.002 | 7.30 | 15.33 | 17.52 |
| 0.0015 | 5.47 | 11.50 | 13.14 |
| 0.001 | 3.65 | 7.66 | 8.76 |
| 0.0005 | $1.82 | 3.82 | 4.38 |

## SIMPLE METHOD OF PRESERVING ARTICLES FOR REFERENCE.

Articles, pamphlets and old catalogs which one may desire to keep for reference may be preserved in convenient form in the following manner:

Select an old out-of-date catalog of good size and having board covers. Strip the covers from the contents and cut off the flexible back up to the point where the stiff boards are glued to it. About ¾ in. from the back edge of the cover and from the inside cut the board cover nearly through lengthwise, as in Fig. 2, so that the back may be broken. This cut line may be made to act as a hinge by bending the cover over a straight table edge, the flexible binding holding the parts of broken board together. Put in such papers as it is desired to preserve, with brass pamphlet pins (Fig. 1), running the pins through the loose pages and the hinge pieces, Fig. 3. The pamphlet pins



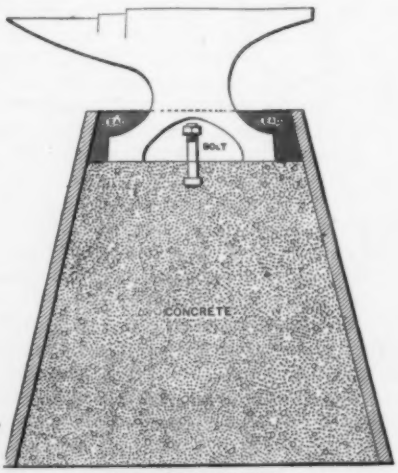

**Preserving Articles for Reference**

cost about 20 cents per 100. Smooth holes may be made through the pamphlet and binder by the use of a belt punch like the one shown at Fig. 4, says the Metal Worker; this tool costs about 20 cents. If wished an index sheet may be bound in with papers, and the covers of the book may be labeled.

## CONCRETE ANVIL BLOCKS.

The difficulty of holding the anvil secure on the block is solved by the use of a concrete block, such as that shown in the illustration.

To make such a block, encase concrete, made of crushed stone and cement, in a rectangular box made of ⅜-in. cast iron, 18 in. high and having a base 14x18 in. tapering to 8x10 in. at the top. The inside measurement at the top should be just 1 in. larger than the base of the anvil, which rests on the concrete 2 in. below the top




**Concrete Anvil Block**

of the casting. On each side of the anvil (front and back) embed a bolt and nut in the concrete to a depth of 3 in., allowing the nut to project upward nearly to the top of the casting and about 1 in. above the concrete. Pour melted lead on top of the concrete, until the space (2 in. deep) between the base of the anvil and the top of the casting is filled. The nut of the bolt and the taper of the casting will hold the lead to the cement.

The cost of mounting anvils in this way is very little, says a correspondent of Machinery, and the noise and vibrations when the anvil is struck are done away with. It takes the poetry out of the ringing blows of the blacksmith's hammer, but will be found a most convenient arrangement, especially for colleges.

## HOW TO MAKE A SMALL STORAGE BATTERY.

Procure an old battery jar about 6 in. high by 4 in. in diameter, and a piece of sheet lead 3 ft. long and 7 in. wide. The lead may be obtained at any hardware store or plumber's. Cut the lead exactly in half, making two pieces 18 in. long and 7 in. wide. Remove a strip 1 in. wide and 17 in. long from each of the plates, leaving them 6 in. wide, with a lug at one end for connections. Cut an old piece of cord or rope ¼ in. in diameter, into four pieces, each 18 in. long. This is for insulating the plates from each other when ready to charge.

Lay two lengths of the rope across one of the plates, about 4 in. apart, and place the other plate upon the two cords, with the two remaining cords laid upon the second plate. Be careful to have the two lugs on the same side and at opposite ends.

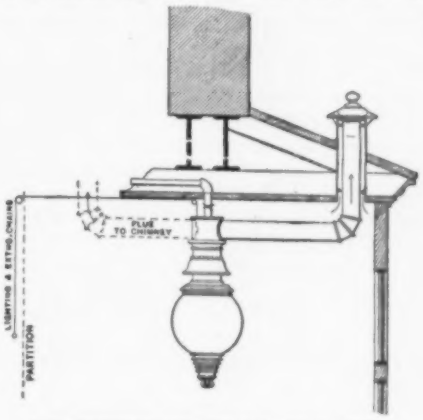
Get a piece of an old broomstick, and carefully wind the whole on the stick, making sure that at no point the lead plates come in contact with each other; otherwise, the battery will be short-circuited and will not receive a charge. It will be found that the coil fits into the jar neatly. The next step is to prepare the acidulated water, which can be easily done by mixing 1 oz. of sulphuric acid with about 10 oz. of water. This is the right proportion, but about twice that amount must be used to fill the jar with two lead plates in it.

The battery is now ready to charge. Either post may be marked plus, but they must not be changed after they have once been charged. The first time the battery will lose its charge rapidly, but the second or third time it is charged it will retain a current for quite a long time. Two or three of these batteries will light a small 2-candlepower electric lamp, or will run a large motor.—Contributed by E. H. Klipstein, East Orange, New Jersey.

## HOW TO PREVENT MOISTURE IN SHOW WINDOWS.

The device shown in the illustration is for securing ventilation in windows lighted by gas in a way that prevents moisture in the windows, says the Acetylene Journal.

A simple 6-in. galvanized iron conductor pipe is fitted tightly over the top of the




For Preventing Moisture in Show Windows

lamp and extends upward and outward into the open air, and carries off the products of combustion. If more convenient, the pipe may connect with a chimney instead of passing through the roof. The lamp is turned off and on by means of chains extending over pulleys to any convenient point. The lamp may be placed close to the ceiling so that it will not hang down in an unsightly position, and it is said that trouble from either frost or moisture is entirely obviated by this means.

Holes as smooth as glass may be obtained in long cast-iron tubes of large diameter, as 15-in. for instance, if kerosene is used as a lubricant and, for boring, a "packed bit," such as is used for gun-boring.

Only lead lined tanks with seams burned together instead of soldered should be used for pickling cast iron in vitriol. The acid ruins zinc and solder in a short time.

## HEAT RESISTING PAINTS.

For painting exhaust pipes or mufflers, the Pacific Coast Gas Association recommends the following paints as being able to withstand anything up to a red heat:

Lampblack, 3 lbs.; graphite, 3 lbs.; black oxide of manganese, 1 lb.; japan gold size, 1 pint; turpentine, 1.5 pints; and boiled linseed oil, 1 pint. Powder the graphite and mix all the ingredients to a uniform consistency. Give two coats.

Or, black oxide of manganese, 2 lbs.; graphite, 3 lbs.; and terra alba, 9 lbs. Mix and pass through a fine sieve, then mix to required consistency with the following compound: Sodium silicate, 10 parts; glucose, 1 part; and water, 4 parts.

## HOW TO SUSTAIN A POLE ON ROCK.

In line-building in mountainous sections, it is often necessary to sustain telephone poles on rock, says the American Telephone Journal, and instead of the ordinary method of making a hole in the rock by blasting, which takes a great deal of time, is very dangerous and expensive, the method illustrated in the accompanying diagram is used.

All that is necessary is to drill five 1¼ or 1½-in. holes in the rock and set an iron pin in each. A hole is bored in the butt of the pole and it is set on the central pin. Guy wires are run from the top of the pole to the other pins. The iron pins are secured in the rock by pouring sulphur or lead around them. An iron ferrule around the butt of the pole keeps it from splitting while being raised.

This is a great improvement on blasting, as it is almost impossible to blast a round hole of small diameter. A blasted hole of sufficient depth is funnel shaped, probably 3 or 4 ft. in diameter at the top and tapering toward the bottom.

## DEVICE FOR SMOOTHING COMMUTATORS.

A simple device such as shown in the sketch, is very convenient in smoothing commutators. It consists of a block, Fig. 1,

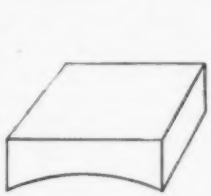


Fig. 1

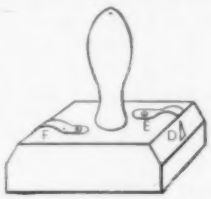
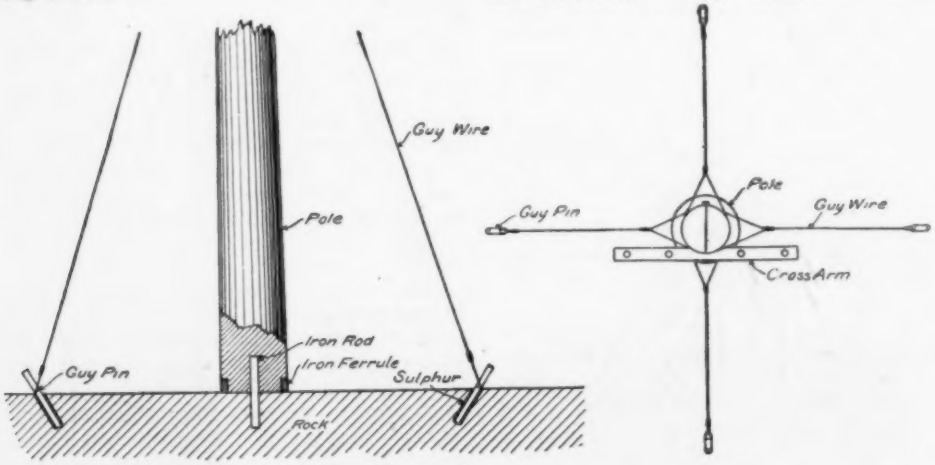



Fig. 2

of hardwood made to fit the circle of the commutator and just as wide, and having No. 00 sandpaper tacked to it. The sandpaper is put on with pointed pins at D, Fig. 2, and has little flat springs, E and F, to hold it down on the pins. These pins have an advantage over tacks, says a correspondent of the Engineers' Review, in that old paper may be removed and replaced with new more easily. A handle on the block keeps the fingers from getting caught in the dynamos.

In working with aluminum the best lubricant for the machine operation of milling is crude oil; for drilling, kerosene, and for turning, plenty of soap water.




Sustaining a Pole on Rock

## SIMPLE ANTI-HUM DEVICE.

Persons annoyed by the humming of telephone wires may prevent the humming by using a piece of No. 14 insulated weatherproof wire, either iron or copper, from the pole to the house.—Contributed by E. H. Umdenstork, Osage City, Kan.

## A SIMPLE RIG FOR WINDING COIL SPRINGS.

In the rig for winding coil springs shown here, the hooked or bent end of the spring is made first, as in Fig. 1. Fig. 2 shows the front elevation of the coiling block, and Fig. 3 the end elevation, the portion at A being rounded off to the same radius as the hooked end of the spring. A plan of the coiling clamp is shown at Fig. 4 and an elevation of it at Fig. 5.

To wind a spring with this apparatus, cut off the required length of wire, grip the coiling block in the vise and insert the wire in the block at the hole, B, and bend over the radius, A. Put the slot in the coiling clamp over the coiling pin, C, of the coiling block and, by means of the winged nut on top, grip the loose end of the wire, in the groove, D, cut in the bolt head.

Wind the coiling clamp around the pin, C, the requisite number of times, keeping the wire tight and even. Then slacken the wing nut and the spring will ease enough to allow the end to be pulled out of the hole. Take off the spring and make the eye in the opposite end by means of the two pegs shown at top of C. Fig. 6 shows the manner of making the eye. Use pliers to finish the end.

A correspondent of the American Machinist who describes this rig, says he uses 16-gage wire, 20 in. in each spring of 8 coils, and that a boy can make 25 springs per hour in this way.

## LUBRICANTS FOR GASOLINE PUMPS.

Nearly all oils are absorbed by gasoline and for that reason the hemp or string used in the stuffing box of gasoline pumps must be kept moist with some liquid or semi-liquid substance which gasoline does not act upon.

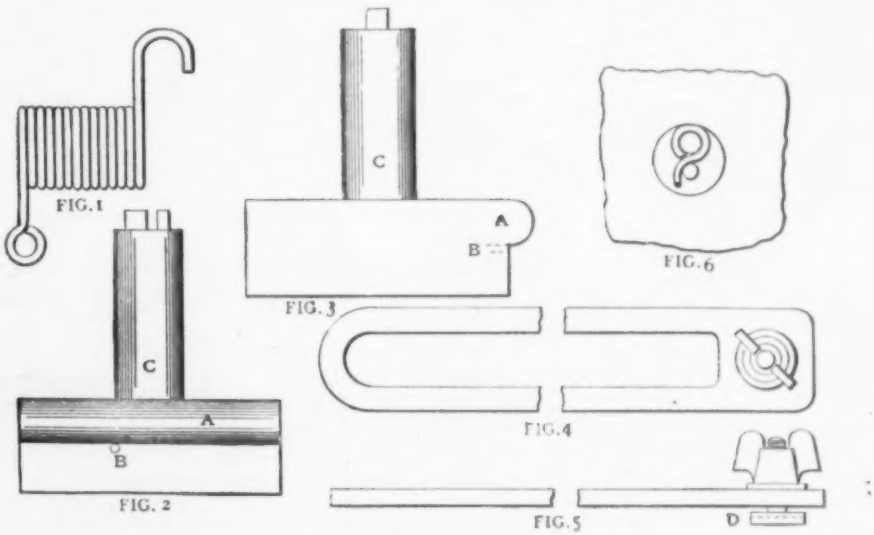
"There are two such substances," says Gas Power; "one is common soap and the other glycerine." First soak the string or packing with glycerine, then screw it down in the stuffing box and the joint will keep moist for a long while. If castile or laundry soap is handier than the glycerine, wax the string thoroughly and the results will be almost as good as with glycerine.

## LIQUID FOR ETCHING ON STEEL.

Either for biting deeply into the metal or for producing a beautiful frosted appearance on the surface, the following liquid for etching on steel may be used:

Sulphuric acid, 1 oz.; alum, ¼ oz.; salt, ½ teaspoonful; vinegar, 1 gill; nitric acid, 20 drops.

The effect produced depends upon the time the liquid is allowed to act.




Rig For Coiling Springs

## MARQUETRY WOOD STAINS.

Wood stains are now used largely in marquetry work instead of, as of old, inlaying the article of furniture to be ornamented with thousands of small pieces of veneer of various colors and sizes. The old process was slow and tedious, the new requires about one-fourth the time. The Decorators' Gasette gives some reliable formulae for these stains, which have hitherto been known only to manufacturers. They are as follows:

EBONY.

6 gals. water.
6 lbs. ground garnet shellac.
3 lbs. ground borax.
1 lb. water ebony A.

WALNUT.

5 gals. water.
5 lbs. ground garnet shellac.
2½ lbs. ground borax.
2½ lbs. Scotch soda.
15 ozs. water walnut A.

OAK.

6 gals. water.
6 lbs. ground orange shellac.
3 lbs. ground borax.
16½ oz. water oak.

PINE.

8 gals. water.
8 lbs. ground bleached shellac.
4 lbs. ground borax.
12 oz. water pine.

SATINWOOD.

5 gals. water.
5 lbs. ground bleached shellac.
2½ lbs. ground borax.
15 ozs. water satinwood.

MAHOGANY.

6 gals. water.
6 lbs. ground orange shellac.
3 lbs. ground borax.
18 ozs. water mahogany 10,522.

GREEN.

6 gals. water.
6 lbs. ground garnet shellac.
3 lbs. ground borax.
12 ozs. pure green P. G. M.

ROSEWOOD.

5 gals. water.
5 lbs. ground garnet shellac.
2½ lbs. ground borax.
1¼ lbs. water rosewood.

Directions for Mixing.—Put shellac and borax into the water, and boil until dissolved, and while still very hot, pour this over the staining color, but never boil up the colors to dissolve them, or they may be destroyed by the heat. Stir up well, and strain carefully when cold. Then bottle for use.

These directions apply to all the formulae, unless specified otherwise.

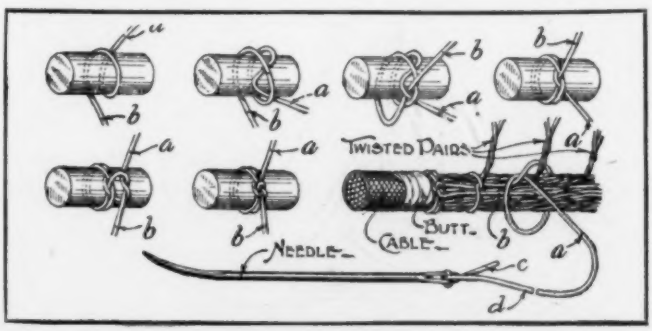
## HOW TO MAKE LIME WHITEWASH.

Slack stone lime, not air-slacked, in hot water, keep stirring and use sufficient water to make a mass like mush when slacked. Thin with sweet skim milk, says the Master Painter, and you will have a whitewash which will not rub off if used inside, or wash off if used outside.

Another good method for ceilings is to slack, as in the first instance, and thin with a solution made of 1 lb. powdered alum dissolved in the least possible quantity of hot water and having sufficient lime added to make 10 qts. of whitewash. This will prevent suction and make a wash that will not work up under the brush when putting on a second coat. A little ultramarine blue, first wet up in water, added to the wash, will improve the tone and make a clearer job. For kalsomining, glutol is an excellent substitute for glue.

## CABLE SEWING KNOTS.

The illustration shows a number of knots used in sewing cables. In each instance A is the needle end of the cord and B is the short end. The "sewing" of the "form," says the American Telephone Journal, is done with a needle. Every lineman should know how to sew these knots.




Cable Sewing Knots

# MECHANICS FOR YOUNG AMERICA

## TO MAKE A BINDER FOR POPULAR MECHANICS.

Get ½ yd. of cloth, one shoestring, a pasteboard box for covers, and some heavy paper. Cut the pasteboard into two covers, ¼ inch larger all around than the magazine, except at the back with which they should be even. Next cut a strip 1 in. wide off the back of each cover. Place the covers on the cloth, Fig. 1, with the back edges ¼ in. farther apart than the thickness of the volume to be bound. Cut the cloth around the covers, leaving 1½ in. margin. Paste the cloth on the covers as they lay, and turn over the 1½ in. margin, pasting down smoothly. Cut a piece of stiff paper to fit and paste on the back. Take a piece of cloth as wide as the cover, and long enough to extend over the back and 1½ in. beyond each "strip." Paste on to hold all together. Two pieces of paper the exact size of the magazine, pasted on the inside of each cover protects the edges of the cloth, and adds to the appearance. Let dry slowly.

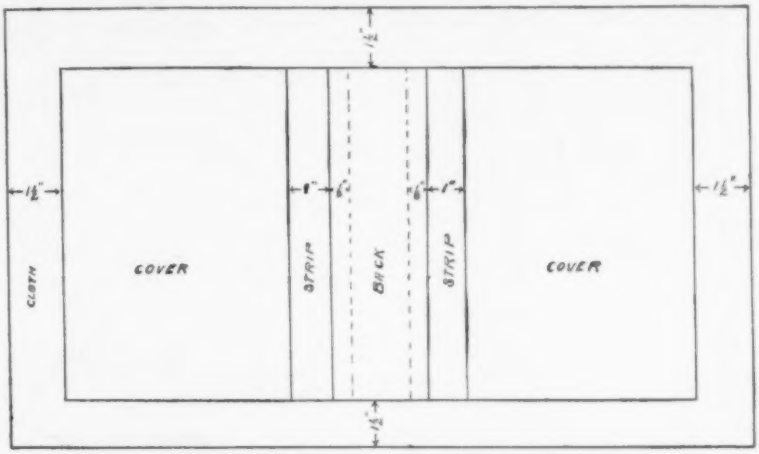



Fig. 1. To Make a Binder For Popular Mechanics

With backs and edges of magazines even, place in a vise and set up tight allowing ¾ in. from back to show above the vise. Bore three 3/16-in. holes ½ in. from the back, one in the middle, the other two 1½ in. from each end. Make corresponding holes in the strips of the binder and use the shoestring to complete as in Fig. 2.—Contributed by L. L. Winans, Mexico, Mo.

## HOW TO MAKE A HAMMOCK.

Any one can make a hammock as good as can be bought and that at a cost so small that every member of the family can possess one providing there are places enough for hanging them.

The materials required are a needle about 7 in. long, and with a big eye, an iron ring for each end of the hammock, two long smooth sticks on which to knit the hammock and two pounds of strong hemp cord or twine. The twine may be colored in any color or combination of colors desired. A Roman stripe at each end of the hammock makes a pretty effect. The cost of the materials should not exceed 75 cents.

A hammock 45 in. wide will not be too

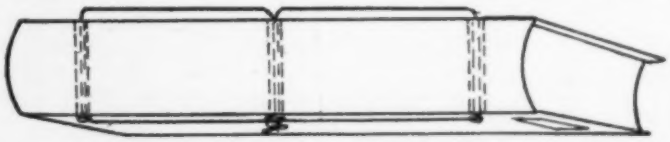


Fig. 2. Binder for Popular Mechanics Complete

large for solid comfort. To knit it first thread the big needle and holding it in the left hand, hold the cord in place with the thumb until you have looped the cord over the tongue, then pass the cord under the needle to the opposite side and catch it over the tongue. Repeat this operation until the needle is full. Cut a 2-yd. length of cord and make a loop and fasten to the door knob or to some other convenient place. Tie the cord on the needle to this loop three inches from the end of the loop. Place the small mesh stick under the cord with the beveled edge close to the loop, and, with a thumb on the cord to hold it in place, pass the needle around the stick and then, point downward, pass it through the loop from the top, and then bring it over the stick so forming the first half of the knot.

Pull this tight and hold in place with a thumb while throwing the cord over your hand, which forms the loop. Pass the needle from under through the loops and draw fast to fasten the knot. Hold this in place and repeat the operation.

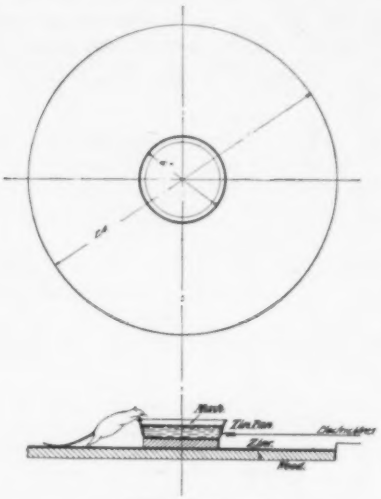
Make 30 of these knots and then push them off the stick and proceed in the same way with the next row, passing the needle first through each of the thirty knots made for the first row. Make thirty rows and then tie the last loops to the other iron ring. Stretchers may be made and put in place and the hammock, strong and durable, is finished. The work must be carefully and evenly done. One is apt to have a little trouble getting the first row right, but after that the work proceeds quite rapidly.

## ELECTRIC RAT EXTERMINATOR.

Some time ago we were troubled by numerous large rats around the shop, particularly in a storehouse about one hundred feet distant, where they often did considerable damage. One of the boys thought he would try a plan of electrical extermination, and in order to carry out his plan he picked up an old zinc floor plate that had been used under a stove and mounted a wooden disc 6 in. in diameter in the center. On this disc he placed a small tin pan about 6 in. in diameter, being careful that none of the fastening nails made an electrical connection between the zinc plate and the tin pan.

This apparatus was placed on the floor of the warehouse where it was plainly visible from a window in the shop where we worked and a wire was run from the pan and another from the zinc plate through the intervening yard and into the shop. A good sized induction coil was through connected with these tires and about six dry batteries were used to run the induction coil whenever a push button was manipulated.

It is quite evident that when a rat put its two fore feet on the edge of the pan



Electric Rat Trap

in order to eat the mush which it contained, that an electrical connection would be made through the body of the rat, and when we pushed the button up in the shop the rat would be thrown two or three feet in the air and let out a terrific squeak. The arrangement proved quite too effective, for after a week the rats all departed and the boys all regretted that their fun was at an end.—Contributed by John D. Adams, Phoenix, Arizona.

## HOW TO BUILD A WIRELESS TELEGRAPH.

An illustrated descriptive article telling how to build a complete working set of wireless telegraph instruments, will appear in this department next month.

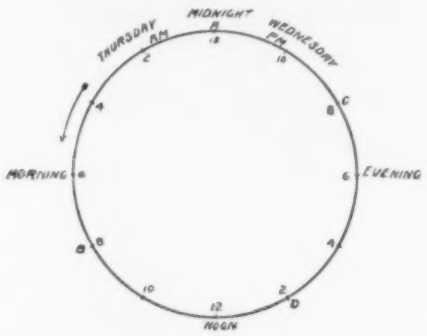
## BOOK FOR BOYS.

We have reprinted in book form a large number of the articles which have appeared in the department "Mechanics for Young America." Tells "How to Build." Every boy should have a copy; 64 pages; price 25 cents postpaid.

## THE DAY.

A correspondent sends the following drawing and questions: "Let the circle represent a circle on the earth parallel to the equator, rotation being in the direction of the arrow. Let point A be a place where it is midnight, say between Wednesday and Thursday. (1) How far does Wednesday extend east? (2) When it is midnight in Chicago between Wednesday and Thursday it is about 2 P. M. in the Philippines, but what day is it?"

The day of a person residing at a fixed place on the earth begins and ends by com-




mon consent at midnight. If one travels west around the world, which is the direction opposite to that of the earth's rotation, he destroys as far as he is concerned one complete rotation of the earth, that is, he loses a day. Traveling east he adds one rotation; that is, he gains a day. He must add or subtract a day to make his reckoning agree with the calendar. To save annoying many people this change is made in mid-ocean.

In some old school geographies is shown a line beginning at Behring Straits, running southwest, curving close to Asia west of the Philippines and then running east through Easter Island almost to the coast of South America. This line is called the "international date line" or "change of day line," and on crossing it going west the traveler calls the day, as regards our questions, Thursday instead of Wednesday. The Philippines lies east of this line, therefore, when it is near midnight of Wednesday, Fig. 1, A, in Chicago, it is about 2 P. M. of Wednesday in the Philippines, Fig. 1, D; and going west of the Philippines to the international date line, and crossing it, we find the people calling the day Thursday.

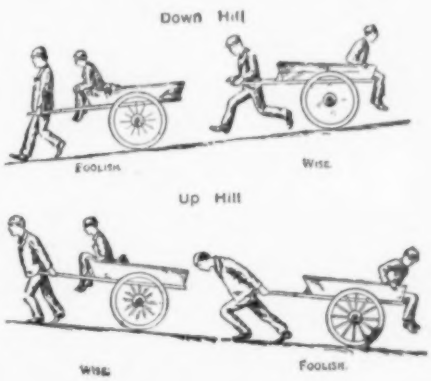
Take an illustration more striking. A person traveling one-half around the world (180°) east or west will find a difference in time of 12 hours. Suppose on Jan. 1, 8 A. M., a man could instantly transfer himself east from London, Fig. 1, B, to a place on the 180 meridian, C (which is near the date line). He would find the date and time there to be Jan. 1, 8 P. M. Suppose at the same time a man starts west from London, B, and reach the 180 meridian in an instant. He will find the time there to be Dec. 31, 8 P. M. Here are two times for the same place differing in day, month and year, and yet both are correct. The two dates arise from the fact that the men reached their destination from different directions. The date most convenient is used. Places lying in Australia or waters near, take Jan. 1, 8 P. M. The Philippines take the American date, Dec. 31, 8 P. M. On the east of the date line, the date is one day earlier than on the west of it. In Alaska this made the American Sunday fall on the former Russian Monday.

## FIVE-YEAR SUBSCRIPTION OFFER.

To the many readers of Popular Mechanics who have expressed themselves as unwilling to have their subscriptions lapse for even a single month, we are now making a special subscription offer of five years for $3. Please notify us promptly of any change of address.

## PROPER DISTRIBUTION OF LOAD.

A great deal of valuable effort is wasted by reason of not knowing how to do things




properly. The cut shows how to place the balance of weight in two-wheel carts or wagons, where the same is to be hauled up or down a hill.

## MEASURING THE FLOW IN UNDERGROUND STREAMS.

In mountain regions, and especially in California, rivers often rise among the mountains, flow for a distance upon the surface, and then suddenly disappear.

In an interesting paper read before the Western Society of Electrical Engineers, Prof. Slichter discussed the flow of water through the ground, and the apparatus used for measuring the rate of flow. Measurements were made among others, upon the Rio Hondu and the San Gabriel rivers east of Los Angeles, California. Rising in a canyon they flow above the ground to its mouth,

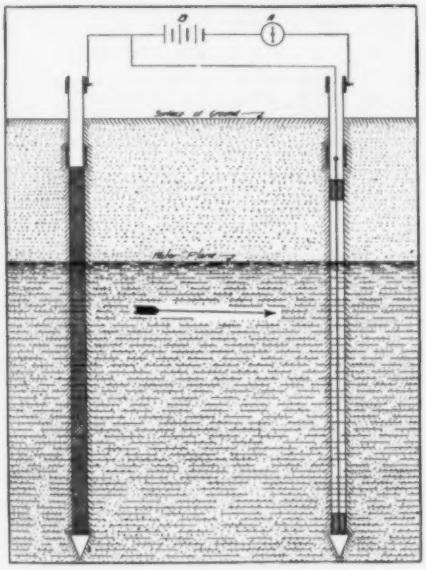


**Fig. 1.**

and then disappear for ten miles. Rates of underflow of from 3.8 ft. to 48 ft. per day were found.

The measurements were made between drive wells sunk for the purpose. Common 1½-in. or 2-in. drive well pipe is used, having on the end an ordinary 1½-in. brass jacket well point from 42 in. to 48 in. in length, with a brass gauze strainer. The pipe is cut in lengths of 6 or 7 ft., threaded 1½ in. at each end, wrought iron recessed couplings being used to fasten the lengths together for different depths. Rolled steel shafting 4 in. long with a hole for the escape of air is screwed on the upper end of the pipe for a driving head, and a heavy oak cylinder 5½ ft. long by 5½ in. in diameter with iron rings shrunk on the ends is used to drive the pipes down.

Fig. 1 shows the way the drive wells are located, AC being the probable direction of the flow as determined by the slope of the land. For deep work the wells are put father apart to throw out any mistakes due to driving the wells not plumb.

In Fig. 2, two wells, say A and D, are electrically connected as follows: On the pipe D is a binding post from which a wire runs to an ammeter, A, for measuring the current; then the current runs through a battery of five or six dry cells and to the binding post on the case of well A. Inside the well D is a ⅜-in. nickled brass rod, 4 ft. long, kept from touching the well case by wooden spools. From the upper end of this rod a rubber covered wire connects with the wire from the casing on well **A** as shown. In every group, each of the down stream wells is connected, as just described, to the upstream well A.

To find how fast water is traveling through the soil from A to B, C and D, a pail of water into which all the sal ammo-

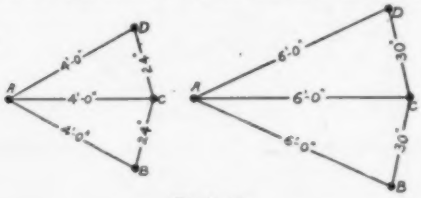



**Fig. 2.**

niac it will dissolve has been placed, is poured into the well A. It will flow toward the B, C and D and being a conductor of electricity, when it reaches any one of the three wells it will form a circuit between the casing and the nickle bar, and a current from the battery will at once swing the ammeter needle well up on the scale. The distance from A to each down stream well being known, this divided by the time elapsing between putting sal ammoniac in well A, and the swing of the ammeter needle, will give the rate of underflow.

Finely powdered sal ammoniac may be used in well A, lowering it as in Fig. 2 by a wire screen bucket holding about two pounds. The method succeeds using only common pipe, and wiring between the casing of up-stream and down-stream wells, leaving out the nickled rod.

Special clock work and self recording instruments have been made which measure the slowest and fastest flows yet found, so that after the wells are driven, wired, and salted, the observer need not be always present. A No. 2 cast iron pipe puller and five-ton railroad jacks will serve to pull the well casings when through.

NEW EDITION NEW EDITION

# POPULAR MECHANICS

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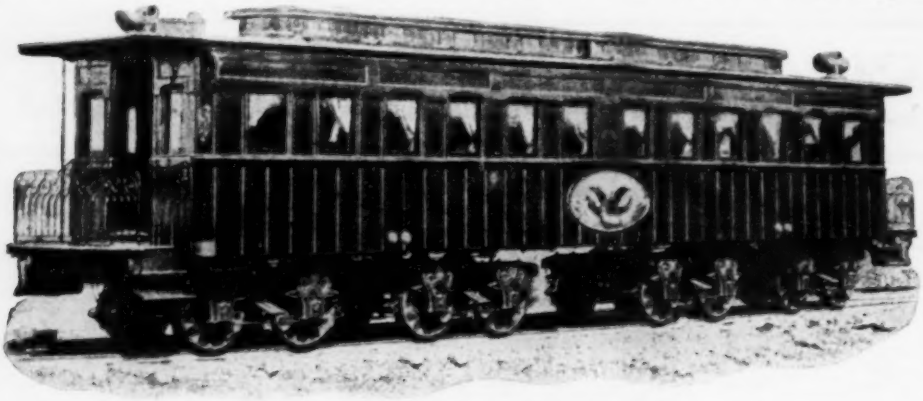
POPULAR MECHANICS

Journal Building, CHICAGO

## PRESIDENT LINCOLN'S PRIVATE CAR.

President Lincoln's private car is an interesting relic, still carefully preserved. It was built at Alexandria, Va., for his personal use and had reached completion only a few days prior to his death. Its first trip was to bear the president's remains, with those of his son, from Washington to Springfield, Ill.



**"Its first trip was to bear the President's remains."**

It was considered a masterpiece of car building in those days, although there are more comfortable coaches today running on suburban trains. The car is low, the ventilation poor, and the windows small. A brakeman had to remain on the platform to put on the brakes by turning a hand wheel when the engineer whistled. Oil lamps furnished the light, and a coal stove the heat. The use of four sets of four-wheel trucks was considered a great feat toward the accomplishment of easy riding, an elliptic spring being placed over each wheel.

## TO PREVENT THE STRIPPING OF PHOTOGRAPHIC FILMS.

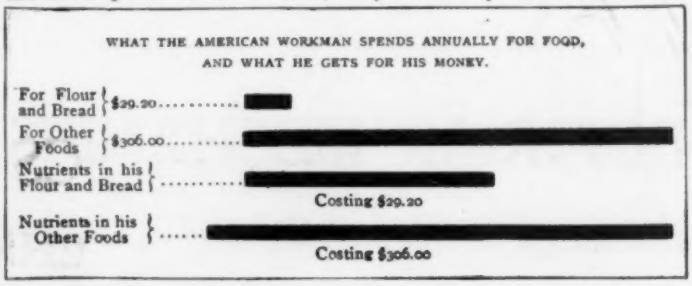
In warm climates it is often difficult to prevent the gelatine film from becoming detached from a plate during development, and the usual methods, such as adding a little alcohol to the developer are not sufficient, says Knowledge and Scientific News, London. Other methods are objectionable on account of their effect on the development or fixing. M. Mercier has lately tried, with good effects, tannin the gelatine. A bath is made up of the following: Alcohol (90 degrees) 250 cc, tannin 60 gr., water 500 cc. The plates are immersed for two or three minutes in this bath, after which they are carefully washed before being placed in the developer. The final washing must be continued until all traces of tannin have disappeared.

## BUTCHER VS. BAKER.

Some interesting comparisons of the relative cost of bread and meat, and their nutritive values is made by Prof. Snyder in the Baker's Helper. He says:

"The butcher gets nearly a third of what the laboring man pays for his food, while the baker and miller together get less than a tenth; but for this third of his income ($110.50) spent for meat, he gets only half as much total nutritive material as is supplied by the $29.20 worth of flour at three cents a pound."

The comparison is graphically expressed by the heavy black lines.


WHAT THE AMERICAN WORKMAN SPENDS ANNUALLY FOR FOOD, AND WHAT HE GETS FOR HIS MONEY.
For Flour and Bread $29.20
For Other Foods $306.00
Nutrients in his Flour and Bread
Costing $29.20
Nutrients in his Other Foods
Costing $306.00